Rock Products
With which is Incorporated CEMENT and ENGINEERING NEWS Founded 1896

Volume XXXV Chicago, January 30, 1932 Number 2

Plant with Special Washing Facilities

Unadilla Valley Sand and Gravel Co., South Edmeston, N. Y., Also Can Furnish Practically Any Size or Grading

SINCE THE WASHING of crushed stone is a timely subject owing to changes in specifications in many states, notably New York state, the new and modern plant of the Unadilla Valley Sand and Gravel Co. at South Edmeston, N. Y., although a gravel operation, should be of interest to crushed stone as well as sand and gravel producers, for here are features that might even be considered radical so far as standard washing practice is concerned.

The deposit is of such a nature that approximately 40% of it must be crushed, and as it is mixed with a considerable amount of loam and clay, rigorous scrubbing and washing is necessary.

Four products are produced; (1) sand, (2) uncrushed gravel, (3) gravel containing some crushed particles, and (4) 100% crushed gravel. These products are kept separate throughout and are washed separately.

At most plants the practice in washing and screening has been to first scrub the pit run material in a rotary scrubber or log washer or a combination of the two, after which the material is scalped, the oversize going in one direction and the finer products in another. Or, the pit-run material is scalped dry early in the operation, the oversize given a superficial washing by sprays, and the smaller sizes then subjected to rigorous scrubbing.

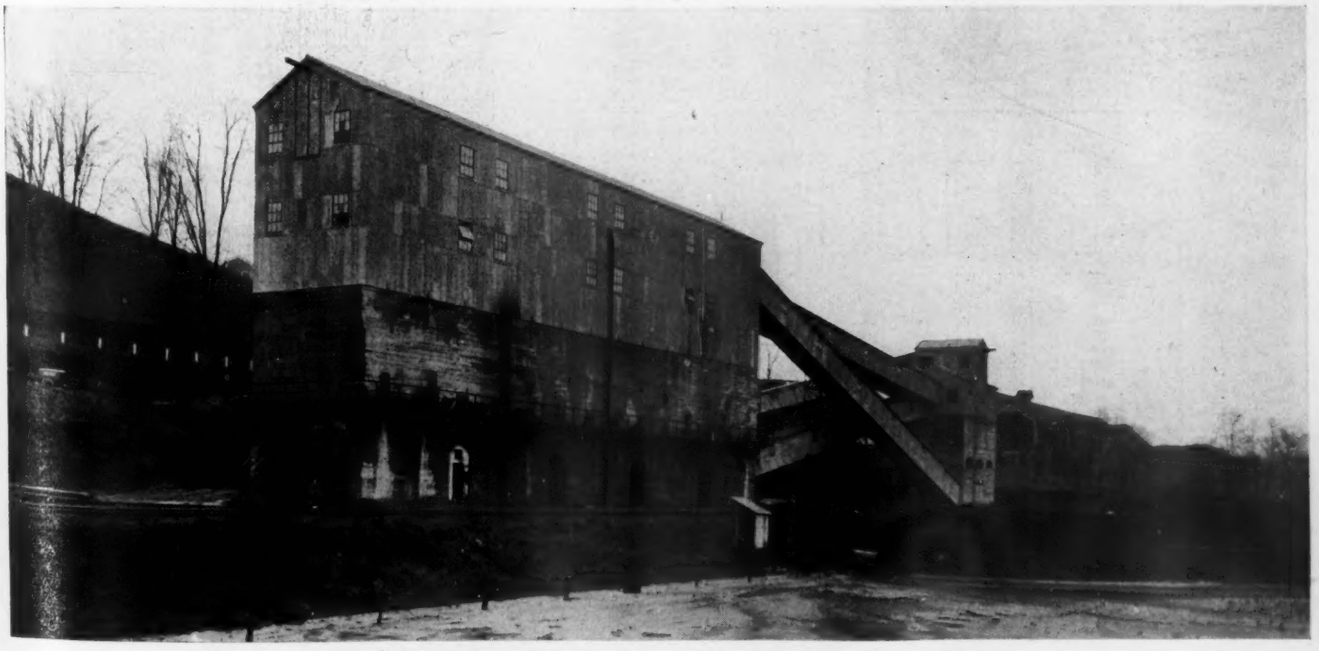
The Unadilla operation, however, is a decided deviation from such more or less standard practice, for the material is classified dry into three general groups and each group is then scrubbed, screened and washed separately.

A great deal of thought was given to the design of the entire operation and no expense was spared in carrying out the ideas of its designers.

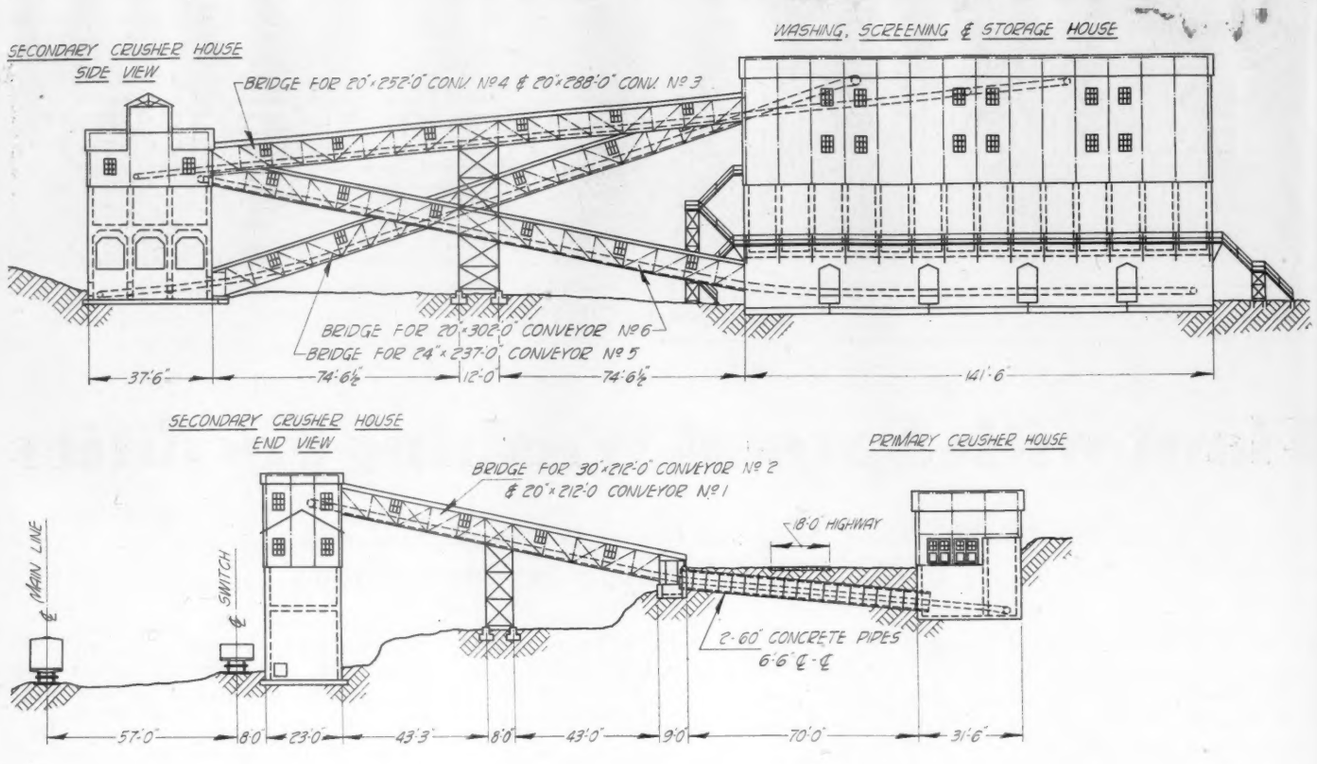
Here also one sees the trend in sand and gravel screening and crushing practice toward the production and the furnishing of practically any size of crushed or uncrushed gravel or a mixture of the two.

Providing in this way for satisfying any reasonable demand on the part of the buyer and giving him a better product at a reasonable cost is one sure and sound way of overcoming successfully the competition of the wayside plant.

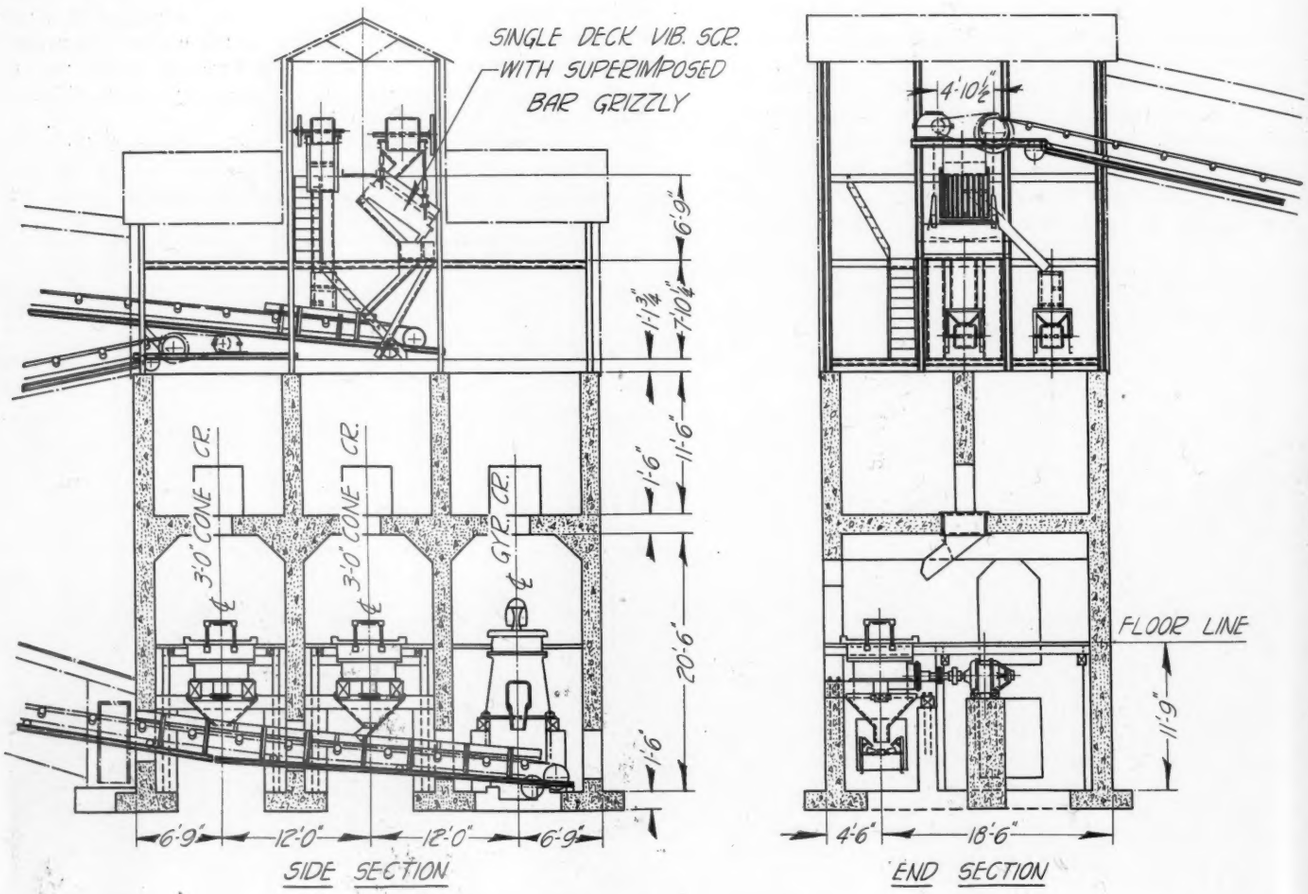
The Unadilla Valley Sand and Gravel Co. was formed and the plant built by the same interests that own the Unadilla Valley railroad but is operated under lease by J. F.



General view of the plant of the Unadilla Valley Sand and Gravel Co.



General arrangement of plant



Sectional elevations at recrushers

Shovel used at the gravel bank

Tractor truck used in stockpiling

Paddelford of Sherburne, N. Y. Mr. Paddelford, who is in the road contracting business, is president of the Sherburne Sand and Gravel Co., which also manufactures concrete tile and posts.

The Unadilla Valley railroad is a short line connecting with the Delaware, Lackawanna and Western railroad at Bridgewater, N. Y., and the O. & W. at New Berlin, N. Y., three miles to the south. The line is approximately 20 miles long and the railroad company became interested in the project as a possible method of increasing its line tonnages. South Edmeston is some 30 miles south of Utica, N. Y.

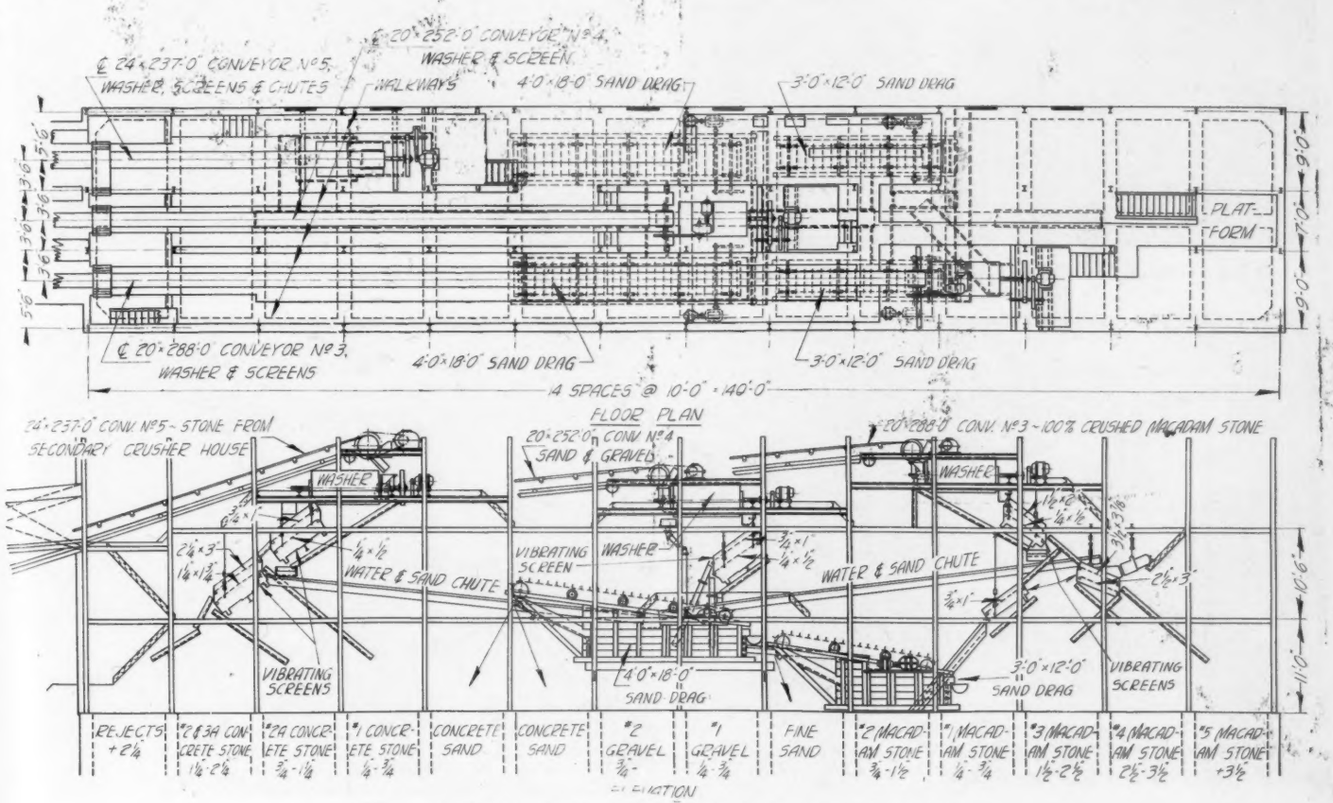
The plant was designed by the Good Roads Machinery Co. of New York, Inc., and was erected under its supervision. Elmer L. Palmer acted as superintendent of construction and remains as operating superintendent. Construction was started in October, 1930, and was practically completed in October of this year.

The plant was designed for a production capacty of 250 tons per hour but this figure has been exceeded considerably during the short time that it had been in operation. A total of 600-hp. of connected motors is used for the entire operation. The general arrangements are shown in the accompanying layouts.

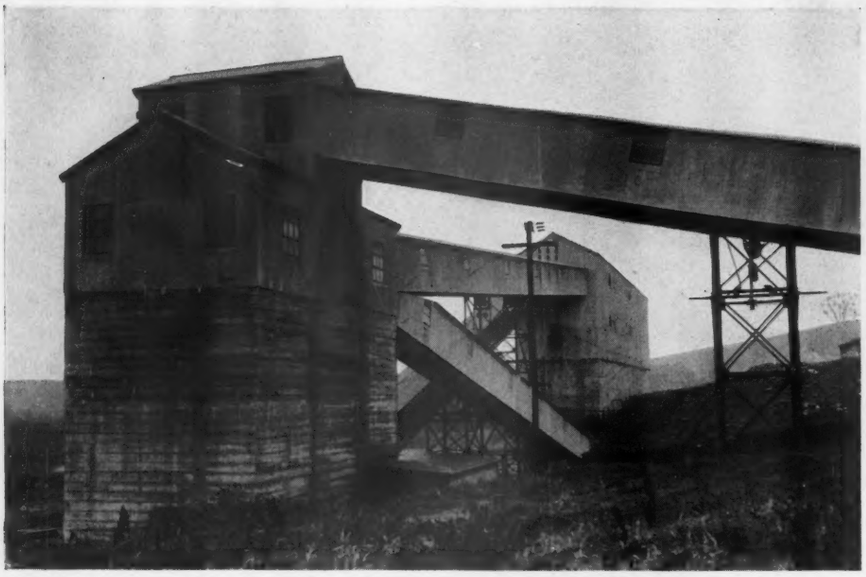
The plant is of steel and concrete construction throughout with steel walkways and suitable handrails, as well as steel steps and cross-overs for passage over the various belt conveyors. The launders are all of steel with steel drainboards below all equipment from which water is apt to drip. Some 200 tons of fabricated steel were used in the steel structures and conveyor galleries.

The loading bins are of heavy reinforced concrete construction arranged in a single row and having 14 separate compartments. Each compartment is approximately 8½ ft. wide and 23 ft. long by 20 ft. deep inside and is capable of holding 200 tons of material, thus giving a total bin capacity of 2800 tons.

Below are two passageways, one for a



Plan and elevation of washing and sizing units above bins



Recrushing building in foreground and washing and screening plant beyond

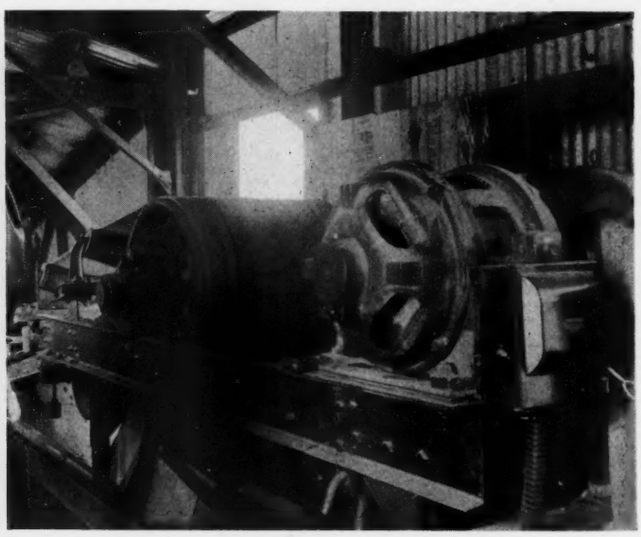
conveyor to stockpiles, and one for a return belt conveyor so that any size can be returned to the recrushing house. Trucks are loaded from chutes on one side and railroad cars on the other. Belt conveyors are used entirely for handling the material through the plant.

The conveyor carriers are of the three-roll type, with flat return rolls, all Alemite lubricated, and were supplied by the Robins Conveying Belt Co. Goodyear belts are used throughout. The lengths, speeds and other data on the conveyor installations are shown in the accompanying table.

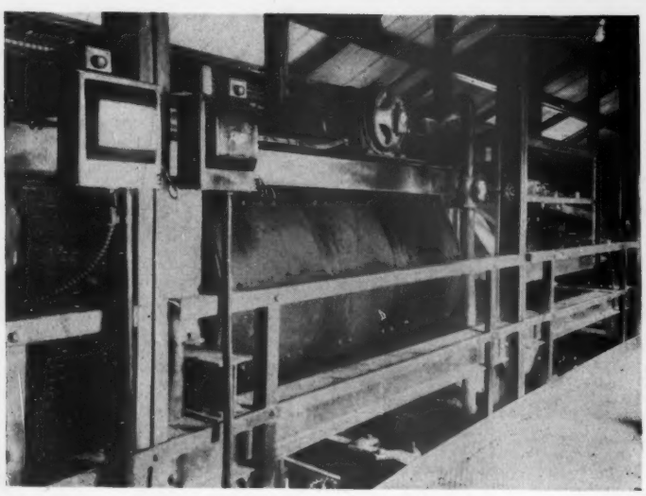
Wherever it was possible to do so the various units in the plant are either direct-connected to motors or are driven through Falk gear reduction units with Falk flexible couplings in conjunction with Chain-Belt roller chains. The exception is the primary jaw crusher which is driven through a 7-strand Dayton cog belt drive.

The electrical installation is entirely modern with features that have been incorporated in very few plants. An interlocking system of wiring is used on the starters so that the units are automatically started in at sequence opposite to the flow of material. When the plant is started the pump is the first unit to start, then the wash boxes or

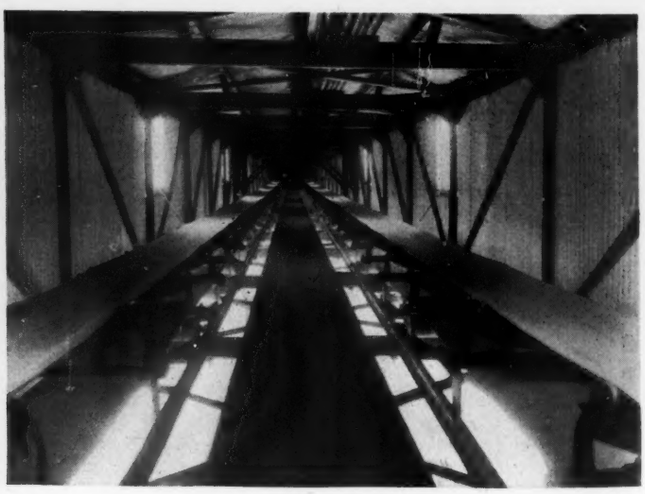
Drive of 20-in. belt conveyor from primary grizzly



Head end of 30-in. belt conveyor from primary grizzly



One of the rotary scrubbers



View in one of the conveyor galleries

sand drags, and then in turn the screens, scrubbers, conveyors and crushers. Also there is a bell and light system so that from the centrally located switchboard the operator can observe whether all units in the plant are functioning properly. On this switchboard, located in the screen house, is a Telechron clock which shows a red signal when the power is off and a white signal when the power is back on the line. Push-button controls are located on this board. The entire electrical installation was designed and all of the motors supplied by the Westinghouse Electric and Manufacturing Co.

Gravel Deposit

The deposit extends along New York state highway No. 8 for some 500 rods and has been opened up as a bank 25 to 75 ft. in height. It is covered with a small amount of overburden which was not removed to start with but it is intended to do any necessary stripping this winter with equipment from the Sherburne plant. The material has satisfactorily met all specifications. Excavating and loading is done by a 1¼-yd. Thew-Lorain gasoline shovel, loading to Linn tractor type trucks. These move the bank material a short distance to the primary crusher house where it is dumped over a grizzly above the primary crusher.

Primary Crusher House

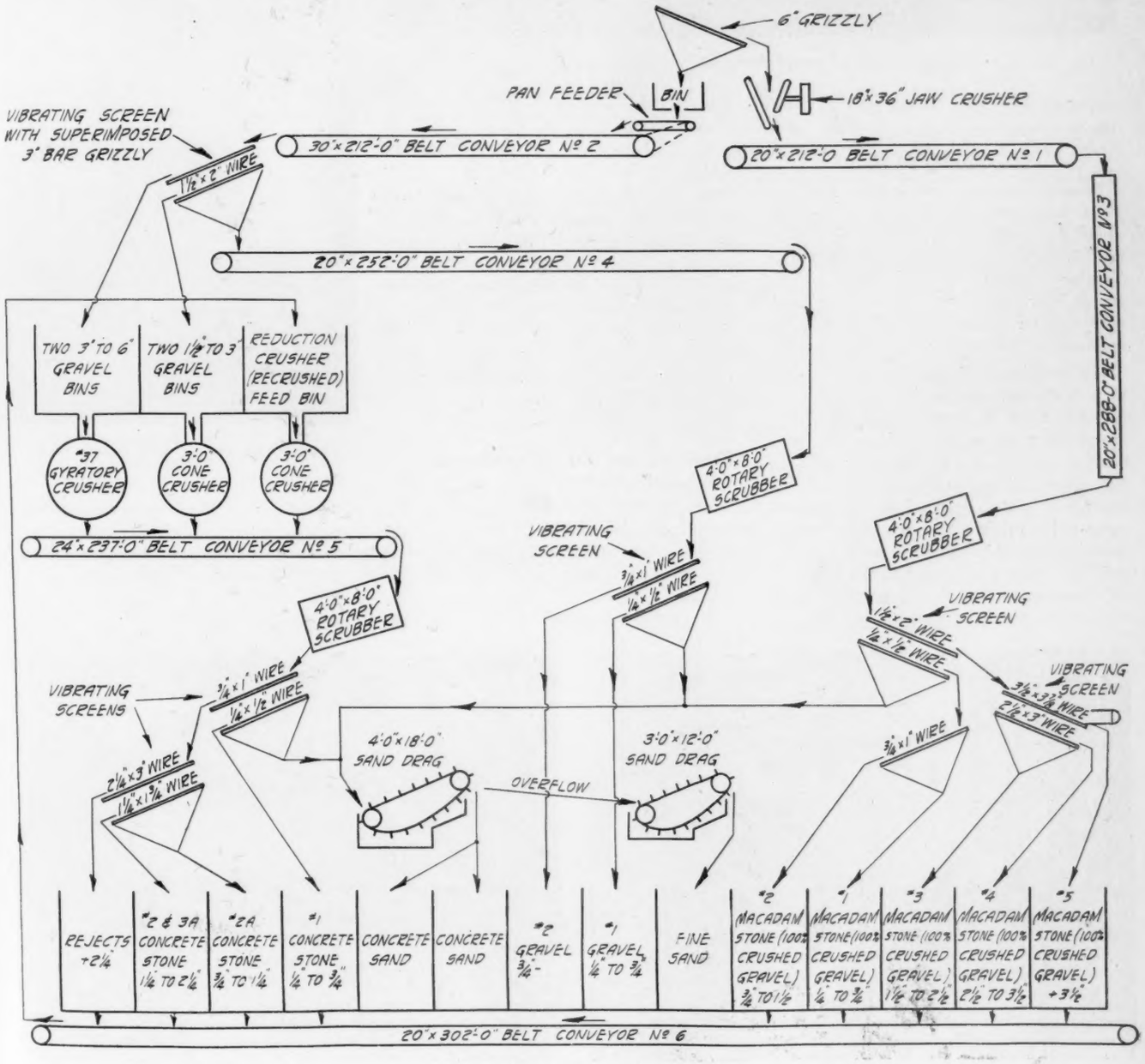
At present a stationary grizzly with rails spaced 6 in. apart is used at the primary crusher, but it is planned to install during the winter a rotary grizzly in order to obtain a better separation, especially during wet weather.

At this point the raw material is separated into two sizes which are handled separately from that point on. The minus 6-in material, containing the sand, gravel and most of any top soil or clayey material, falls to a hopper and is delivered by a pan feeder to a 30-in. belt conveyor (No. 2).

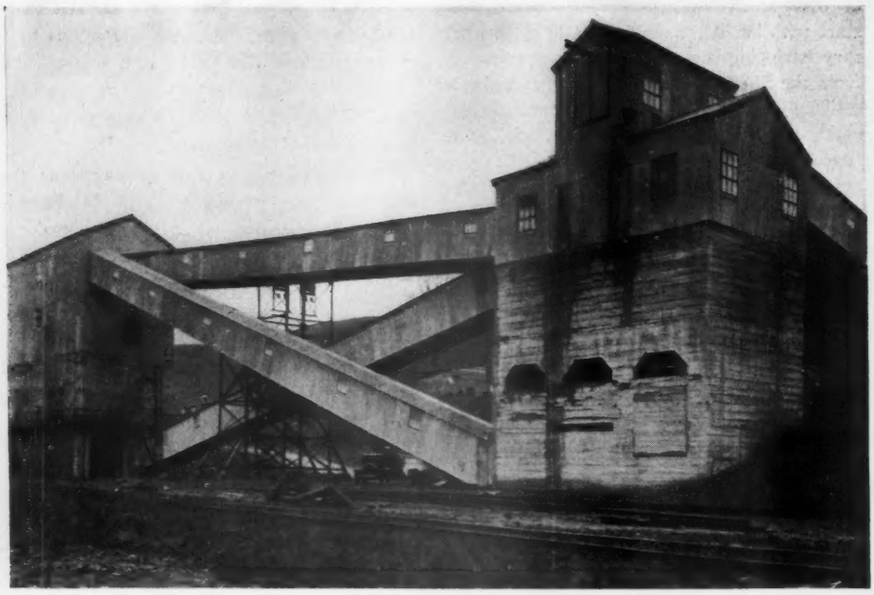
The plus 6-in. material passing over the grizzly falls to an 18-in. by 36-in. Farrel-Bacon jaw crusher which is set to make a 3-in. product. The crushed gravel falls to a 20-in. belt conveyor (No. 1), which is parallel to the main 30-in. conveyor.

This crushed material is kept separate throughout the balance of the operation and is finished in its own scrubbing and screening unit. It is the source of the 100% crushed gravel, locally known as macadam stone.

Both belt conveyors pass under the high-



Flow sheet of complete plant



Front view of recrushing and scalping plant

way which divides the pit and primary crushing operation from the balance of the plant.

Recrushing Plant

From the primary crusher house the main 30-in. belt conveyor (No. 2) carries the minus 6-in. material to the top of the recrushing plant, where it is discharged to a Traylor vibrating scalping screen. This screen is arranged with 1½- by 2-in. mesh wire cloth on the main deck and has a superimposed bar grizzly with 3-in. clear openings.

The oversize, or 3- by 6-in., material falls to a reinforced-concrete bin from which it is fed to a No. 37 Kennedy-Van Saun gearless crusher below, which is driven by a direct-connected 50 hp. 300 r.p.m. synchronous motor. The material passing over the main deck of the screen falls to a second concrete bin, below which is a 3-ft. Symons cone crusher. Alongside this unit is a second 3-ft. Symons cone crusher which is used for recrushing any of the 11 aggregate sizes produced by the plant, these sizes being returned by means of a belt conveyor (No. 6) extending from below the main loading bins to a small concrete bin above the cone crusher.

The fines passing through the main deck of the scalping vibrator consist of the sand and uncrushed gravel. This material is carried on a 20-in. by 252-ft. inclined belt conveyor (No. 4) to one of the three scrubbing and screening units above the main bins.

The 100% crushed gravel from the primary crusher is delivered by conveyor No. 1 to conveyor No. 3, which then carries it in the same gallery with conveyor No. 4 to the main screen house over the bins.

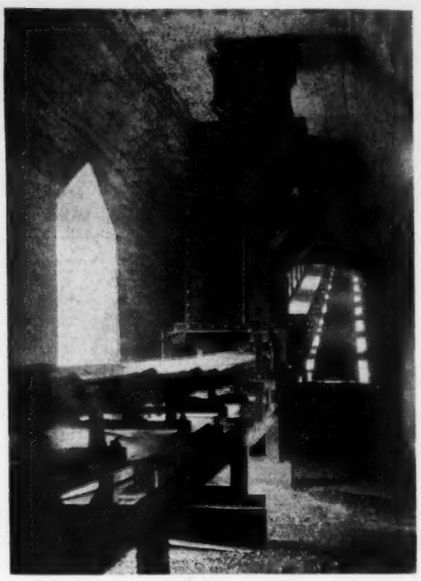
Scrubbing and Screening Operations

The washing and sizing of the different products is done in three separate units located above the main bins. Each unit consists of a rotary scrubber followed by one or more vibrating screens, where the material is rinsed.

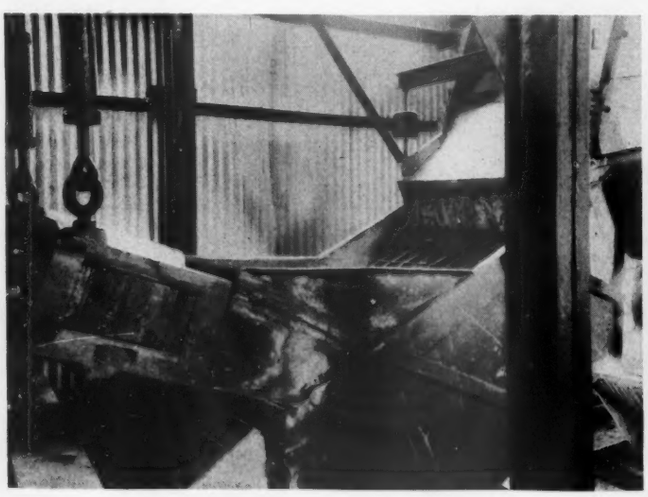
The sand and uncrushed gravel from conveyor No. 4 goes to a 4-ft. by 8-ft. Good Roads rotary scrubber which in turn discharges to a double-deck Traylor vibrating screen. This screen has ¾- by 1-in. mesh wire cloth on the upper deck and ¼-in. mesh cloth on the lower deck and separates out the ¾-in. gravel, ¼- by ¾-in. gravel, and sands.

The sands are sluiced to two 4-ft. by 18-ft. sand drags which remove the concrete sand, and the overflow then passes to two 3-ft. by 12-ft. drags which remove the fine sands used for plastering and masonry work. These fall to bins below.

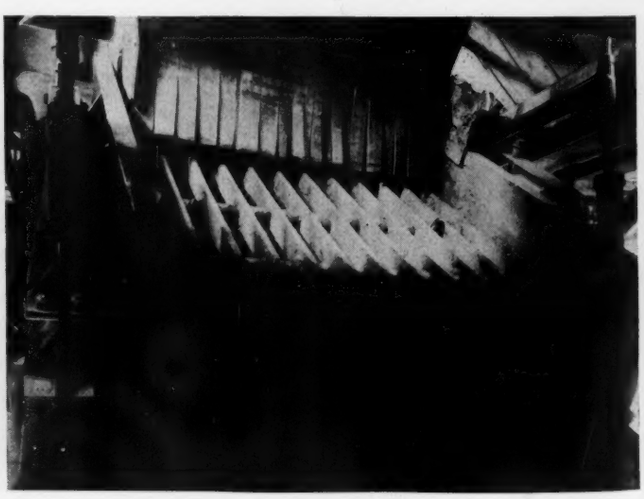
The 100% crushed gravel carried by conveyor No. 3 is likewise delivered to a 4-ft. by 8-ft. Good Roads rotary scrubber which is provided with lifter baffles and replaceable liner plates. Two 3-in. water lines serve this scrubber and deliver to it approximately 400 gallons of water per minute. After being scrubbed, the gravel falls to a battery of three Traylor vibrator screens.



Chutes and return belt below main bins



Conveying-vibrating screen



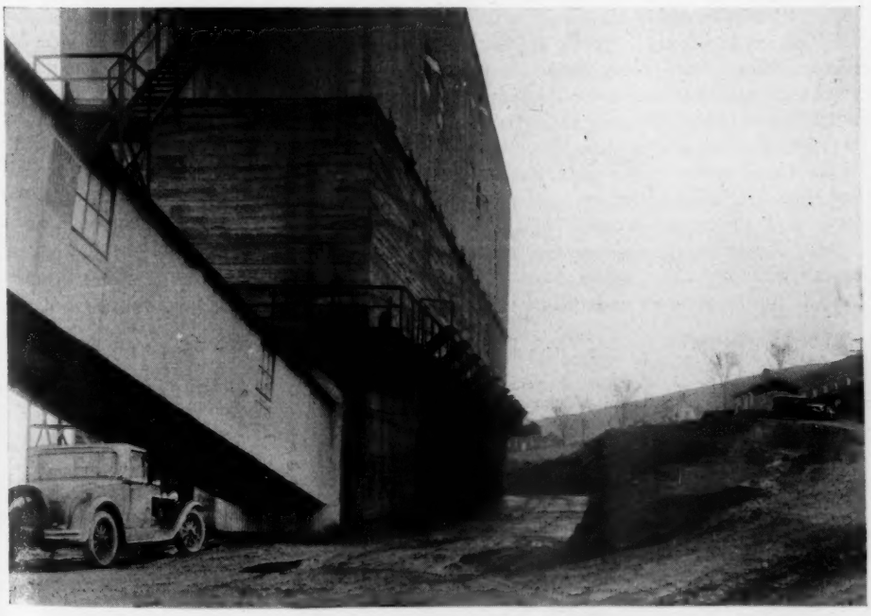
Vibrating screen with bar grizzly

One of the sizing vibrating screens

where five sizes of 100% crushed gravel (macadam stone) are separated out to bins. These sizes are: ¼-¾-in.; ¾-1½-in.; 1½-2½-in.; 2½-3½-in.; and a plus 3½-in. stone. The fine material from this battery of screens flows to one of the two batteries of sand drags. The five sizes of crushed gravel are all chuted to the reinforced-concrete bins below, where they can be either drawn to cars or trucks for shipment, or can be returned to the recrushing plant.

The arrangement of the three screens is as follows: The scrubber discharges to a two-deck Traylor vibrating screen, which is provided with a top deck of 1½- by 2-in. wire cloth and a lower deck of ¼-in. mesh wire cloth. The oversize from the top deck is chuted to a second Traylor vibrating screen, which has a top deck of 3½-in. by 3⅞-in. wire cloth and a lower deck of 2½-in. by 3-in. wire cloth. This screen then produces the plus 3½-in. crushed gravel; the 2½-in. by 3½-in. and the 1½-in. by 2½-in. crushed gravel. This vibrating screen, referred to as the conveying type, not only screens the gravel but conveys it a short distance so that its output can fall through chutes to the proper bin.

The oversize from the lower deck of the first screen is chuted to a single-decked Traylor vibrator which has a ¾-in. by 1-in. wire cloth and this screen produces the ¼-in. by ¾-in. and the ¾-in. by 1½-in. material. The fines from the ¼-in. mesh lower deck are chuted to the sand drags and mixed with the sand from the other screens.



Trucks are loaded at one side of the bins

Crushed Gravel Also Washed

The third scrubbing and screening unit is used for the material coming from the recrushers. This is handled on a 24-in. belt conveyor (No. 5) which passes under all three of the recrushers and carries up to the third scrubber, which is the same size as the other two. From the scrubber the material falls to two double-deck Traylor vibrating screens operating in tandem. The upper screen has a top deck of ¾-in. by 1-in. wire cloth and a lower deck of ¼-in. by ½-in. wire cloth. The lower screen has an upper deck of 2¼-in. by 3-in. wire cloth with a lower deck of 1¼-in. by 1¾-in. wire cloth. These two screens produce a plus 2¼-in. reject material; a 1¼-in. by 2¼-in. size; a ¾-in. by 1¼-in. size; and a ¼-in. by ¾-in. size, all of which are mixtures of crushed and uncrushed gravel. These products all fall to the reinforced concrete bins below with the exception of the fines which flow through steel launders to the larger sand drags.

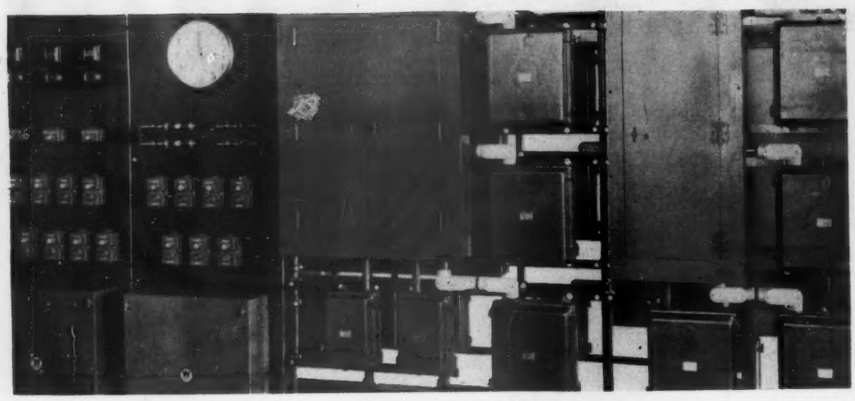
Passing below all the bins is a 20-in. belt conveyor (No. 6) on which any of the sizes can be drawn through suitable gates and returned to the concrete bin over the 3-ft. Symons cone crusher for recrushing. This crusher is set for a 3-in. feed and is provided with a fine crushing bowl. In this manner any of the larger sizes which may be unmarketable can be reduced to smaller and more saleable products. The recrushed gravel falls to the same 24-in. belt that serves the gyratory and second cone crusher and is returned to the "mixed" scrubbing and screening system. Most of this "mixed" crushed and uncrushed gravel comes from the 3-in. superimposed grizzly of the scalping screen, which product goes to the No. 37 gyratory crusher in the recrusher house. Part of it also comes from the cone crushers.

It is estimated that the deposit contains about 10%, which must be crushed in the primary crusher and goes to make 100% gravel. About 60% is uncrushed gravel and sand and the balance is the mixture of crushed and uncrushed gravel.

General

Stockpiling is done by means of the belt conveyor already mentioned and the material is reclaimed by a crane with clamshell bucket.

Water for washing is furnished by a 1600 gal. per min. Rumsey centrifugal pump which is driven by a direct-connected 100-hp. Westinghouse motor. Of this total water 400 gal. per min. goes to each of the three rotary scrubbers and the balance is divided about equally between the six screens. The



Main switchboard

pump delivers to the plant through a 12-in. pipe line from a creek about 500 ft. from the plant. Detailed information on the drives and motor sizes is given in the tables following. Westinghouse motors are used throughout.

MOTORS AND TYPES OF DRIVE AT UNADILLA PLANT

	Motor size, hp.	Drive
Primary jaw crusher	100	7-strand, Dayton cog belt drive
No. 37 secondary crusher	50	Direct connected
3-ft. secondary cone crusher	50	Direct connected
3-ft. finishing cone crusher	50	Direct connected
Conveyor No. 1	15	Falk reducer and chain
Conveyor No. 2	25	Falk reducer and chain
Conveyor No. 3	15	Falk reducer and chain
Conveyor No. 4	15	Falk reducer and chain
Conveyor No. 5	25	Falk reducer and chain
Conveyor No. 6	25	Falk reducer and chain
Scrubber No. 1	20	Falk reducer and chain
Scrubber No. 2	20	Falk reducer and chain
Scrubber No. 3	20	Falk reducer and chain
Sand drag No. 1	10	Falk reducer
Sand drag No. 2	10	Falk reducer
Sand drag No. 3	5	Falk reducer
Sand drag No. 4	5	Falk reducer
Water pump	100	Direct connected
7 vibrating screens	35	
	595	

BELT CONVEYORS AT UNADILLA PLANT

Conveyor No.	Width	Center to center length
No. 1	20-in.	212-ft.
No. 2	30-in.	212-ft.
No. 3	20-in.	288-ft.
No. 4	20-in.	252-ft.
No. 5	24-in.	237-ft.
No. 6	20-in.	302-ft.

Pump house of concrete blocks

Standardized Sieving Methods

THE ERRORS in the ordinary methods of sieve analysis are cumulative, because the undersize of one screen makes the feed for the next, any error on the first screen is transmitted through the series. Alan Probert writes of this in *Engineering and Mining Journal* and shows how this cumulative error may be prevented.

The necessity of better screening methods has long been realized and in 1922-24 co-operative research was undertaken by the U. S. Bureau of Mines, the Massachusetts Institute of Technology, the American Institute of Mining Engineers and the University of California. One result of this investigation was the method proposed by John Gross of the U. S. Bureau of Mines. It included a time-percentage end point and the wet sieving of the whole sample for desliming prior to dry sieving the coarser portion of the sample. Losses were easily allocated by weighing oversize as well as undersize after separate manipulation of the sieves. The accuracy of this method is such that duplicate screenings of the same sample will check plus or minus 0.05%.

"But," says the article, "the high degree of accuracy inherent in the Gross standard hand-sieving procedure is rarely a justification for the extremely tedious work required by the separate manipulation of the sieves." For this reason the author of the article has devised a method which retains the accuracy of the Gross method while consuming much less time. It includes the wet split on 200-mesh and the time-percentage-weight end point. The sieving is done on the standard Ro-tap machine. The author says he has used it for three years and believes that it has advantages which cannot be claimed for any other method.

A convenient size of sample is 1 kg. and it should be carefully cut down from the whole. The end point weight, found in sieving, is thus 1 gram. The sample is first wet down in a pan and the suspension of fine particles decanted off into a suitable container. This is repeated two or three times, or until the remainder of the sample is clean enough to wash on a 200-mesh sieve. Then part of the sample is spread in a thin layer over the 200-mesh sieve, water is poured in and the frame of the sieve tapped repeatedly to cause a slight motion of the particles. When the water has run through, the process should be repeated until the water comes through practically clear. Brushing, rubbing with the fingers and washing with a high pressure jet should be avoided, as they contribute to inaccuracy. Thorough performance of this wet splitting will save time in the dry sieving that follows. The wet fractions are dried and weighed separately; the sum of the two weights may be taken as 100% for further calculations, avoiding small errors such as would come from small amount of soluble constituents.

In the dry sieving that follows the end point is based on the premise that under standardized conditions of sieving only a designated amount of undersize must be produced in a given time. This has been arbitrarily taken as 0.1% in one minute. (Hence with a 1 kg. sample the end point is when 1 gram is produced by one minute of sieving.) After a preliminary sieving the sieves are thoroughly cleaned by brushing both sides to remove all dust and particles held in the meshes. From this point the sieves are treated individually, the oversize being returned to the cleaned sieve and shaken for one minute at a time. Should there be much blinding after the end point is reached, the result should be checked by another one-minute test, as a blinded screen frequently gives a false end-point. The preliminary sieving should be such that the end-point should be reached in two or three one-minute periods. Fifteen-minute periods followed by thorough brushing give satisfactory results. The following schedule will be found useful: From 3- to 28-mesh, one 15-min. period; from 35- to 48-mesh, two 15-min. periods; from 65- to 200-mesh, three 15-min. periods.

A table given in the article, reproduced here, shows the enormous difference between the thorough screening by the method described and the ordinary 15 min. dry screening in the Ro-tap machine. The minus 200-mesh was raised from 44.1% to 67.6% and the minus 65 plus 100-mesh was lowered.

RESULTS OF SIEVE ANALYSIS, BY VARIOUS METHODS, ON THE SAME SAMPLE OF ORE

Mesh size	A	B	C	D	E	F	G	H
Minus 200	44.1	47.3	48.1	64.7	65.5	66.2	67.6	67.6
Minus 150, plus 200	23.9	24.4	27.0	14.6	15.0	15.2	14.5	14.4
Minus 100, plus 150	8.5	8.6	8.1	6.6	5.8	6.2	5.8	5.9
Minus 65, plus 100	18.6	15.7	13.4	10.2	10.2	9.6	9.3	9.3
Minus 48, plus 65	3.9	3.0	2.8	3.1	2.7	2.5	2.5	2.5
Plus 48	1.0	1.0	0.6	0.8	0.8	0.3	0.3	0.3

A: 15 minutes dry sieving—no wet split.
B: 30 minutes dry sieving—no wet split.
C: 60 minutes dry sieving—no wet split.
D: Deslimed wet, oversize dry sieved for 15 minutes.
E: Deslimed wet, oversize dry sieved for 30 minutes.
F: Deslimed wet, oversize dry sieved for 45 minutes.
G: Deslimed wet, preliminary sieving according to schedule, all end pointed.
H: Deslimed wet, preliminary sieving according to schedule, all end pointed.

"Better Times Are Just Around the Corner"

And How!

By Theron C. Taylor
President, Sand-Lime Products Co., Detroit, Mich.

THIS PHRASE has been repeated so many times that, like the fable of the boy who called "Wolf," we are liable to fail to realize when it appears as the true situation.

Business has been very sick. Thousands of doctors have prescribed, thousands of others have said there is no cure, thousands through wrong diagnosis have only added to the misery. In spite of it all the patient is now showing some signs of a change for the better.

There seems to be much difference of opinion regarding the ability of man to control business cycles. If there were no business there could be no business cycles. Man created business. Has he created something which he cannot control— a Frankenstein? Babson is a student of business. He says business can be regulated.

Try, and Try Again

Because previous attempts to regulate have failed is no reason to assume that further efforts must be of no avail. It required many attempts before man was able to fly. Most successes have been created from attempts which once failed.

A resumé of the voluminous literature on the subject of depressions, their causes and remedies, indicates that at least most of us desire that a solution be reached. The magazines and newspapers in particular have conveyed many constructive suggestions.

It must be realized that a few people can tear down, destroy or nullify the constructive efforts of many. There are thousands who feel that lower prices will bring prosperity. It is quite natural that we enjoy the effects of a gasoline price war and we regret to see the prices re-established. However, everyone is suffering from the effects of cutting prices of commodities, foodstuffs, clothing, cars and building materials as well as gasoline. The producers of these goods are in general operating at a loss. They have no money to repair or improve equipment and properties. They are eliminating every unnecessary expense including many men. An upward movement of prices would permit them to give jobs to the unemployed. Never do we see low prices and good times together.

It is not the province of this article to try to place any blame for the present conditions, nor to suggest that any particular class or group of people can or should provide for its solution. It is significant that no one accepts any responsibility for the conditions, and no one or no group seems to feel equal to the task of appreciably altering conditions. If this article serves to consolidate the efforts of all who desire to take part in a movement to bring an early return of prosperity it will have served its purpose.

There Are Plans Available

Of course everyone is interested in bringing about a return of prosperity. Rich or poor, employed or unemployed, young or old, male or female, everyone can help. Five plans are offered. It is not necessary that everyone agree with all suggestions. Perhaps it is best that different groups and individuals sponsor only those ideas with which they are in complete harmony, and to which they can give vigorous and immediate support.

Out of the mass of suggestions offered through the press, magazines and letters to unemployment committees, all may be classified under these five headings—*Banking, Credits, Buying, Public Works* and *Employment Distribution.* Taken singly no one item can be very effective at restoring prosperity; all should be used simultaneously as a means of putting business back on its feet and to so regulate or control, that business will remain almost free from fluctuations.

Banking

Many banks, like individuals, have failed. Their owners have lost everything. All banks, fearing runs, are endeavoring to carry large cash reserves. Carrying idle money reduces their opportunities for profit and increases their danger.

Fear of bank failures has caused many people to so conceal their savings that they are taken out of circulation. Money is therefore not as plentiful as it should be for commercial activities.

It is to be hoped that the new banking syndicate set up at the suggestion of President Hoover may operate to restore confidence in our banking system and not become merely another depository where idle funds may be kept idle. Would it not be a simpler procedure and more directly to the point if congress would provide for a change in the Federal Reserve Act to authorize the Federal Reserve system to assume responsibility as receiver for banks with frozen assets, thereby eliminating all possibilities for bank failures.

Was it not the purpose of the Federal Reserve System to help in eliminating depressions by keeping money available for business? Where are those funds today? Did not the banks call their industrial loans; did they not return loans to the Federal Reserve? What did the Federal Reserve do with the money? To what extent are the Federal Reserve and our banks, as well as individuals, hoarding money?

Is there a way to stop hoarding of money? Germany did no money hoarding a few years ago when their government started its rapid printing of paper money. It may not be necessary for our government to go to such an extreme, but perhaps a little deflation of money and consequent inflation of values of commodities might work wonders. If distribution of this paper money is any problem, there are numerous groups such as the farmers, the American Legion and the unemployed who would be pleased to cooperate.

To bring about reforms, we sometimes have to reckon with causes. It may be embarrassing to some interests to have the depression end before some official action is taken regarding German reparations. In other words, has Germany borrowed private capital to pay a public debt, and should the public debt be made void so that she can repay the private capital?

While this controversy runs its course, if such it must, must business stand still, or is there a way to get potatoes to the hungry in return for their labor or products of their labor? Can industry trade commodities? What kind and scope of exchange system is necessary? Can it set up its own commercial paper in the form of IOU'S, notes, trade acceptances, etc., which may be passed from one to another without the intermediary of a bank?

Credits

It seems to be an all too common fallacy to presume that what is bad policy at one time may never be the basis for good business, and what is good policy at one time is always O. K.

Most anyone, and especially those who sold homes in the early part of 1929, can look back on the subsequent events and realize fully the disastrous effects of a too easy credit policy. We have learned a lesson, but how are we going to interpret and utilize our findings?

Mob psychology is a strange thing. It causes most people to buy at the top and sell at the bottom. Bargain prices will not induce people to buy homes. In fact, when prices are down, they expect every new move to be further down. A seasonal rise in material prices, even though not warranted by costs would temporarily benefit the

industry. But what will the industry do if, and when, a new lag in sales looms up?

Credit offers the solution to most effective control of sales. Mortgage money should be easy when sales are below normal or tend to decline; it should be stiffened even to complete elimination, if necessary, to prevent excessive sales. The industry can be maintained at normal during all extremes of general business fluctuation by control of credit alone.

Credit is a matter of confidence in the other man. Will our Building Congress improve the credit situation by closer association?

Must the building industry remain content with a supply of mortgage money which swells to almost unlimited proportions when business is above normal and then disappears to force this industry almost to a standstill? Can a new set-up be devised which will keep the industry on a steady level by so regulating the supply of money as to prevent excessive departures from normal?

Buying

Perhaps we have heard too often the request to start buying. Those who have been out of work for months ridicule the idea. However, there are those who can assist in this phase and to their own aggrandizement.

Goods can be purchased at present low prices for consumption during future periods of higher prices. Property now begging for a purchaser with a few dollars in cash will return many times the investment in a few years, just as it did a few years after the depression of 1921.

Money in the bank at 3% can be safely used to buy listed stocks paying 6%, which will double or triple in value in a few years, and while so carried can be converted into cash almost as easily and quickly as can the savings account.

It is easy to be an optimist and overbuy when times are good. Such optimists become pessimists when business declines. Such people are in the majority and are usually found trying to "keep up with the Jonesses." The man who acquires wealth usually has foresight, and is generally considered a "nut" or a "crank" because his actions are the reverse of those of the general public. He is a pessimist and sells his goods when times are good because he knows that the next change must be for the worse. Then when conditions are bad he is an optimist and buys to take advantage of increasing values.

The country's wealth is consequently falling into the hands of a few—the wise. Shall we try to teach the majority how to make money, or shall we put heavier taxes on incomes to make it more difficult for the real expert in business to get such complete control of this world's goods?

Several years ago a man who lost money considered it a disgrace, but he took great pleasure in boasting of his profits. Today when great credit would accrue to him for such accomplishments, he prefers to talk of his losses. Because the majority are losing is no reason why such admissions should be popular. Buying can be accomplished, in volume, and without much cash, if everyone uses a little ingenuity. Buying should temporarily take the form of trading commodities. When trade proceeds without money, the cash will soon return to circulation and with lessened demand will have to accept lower rates of return than formerly.

To what extent would sales and business be stabilized by having fixed prices on all commodities, subject only to change by agreement of a group of producers or by government control? Such a plan would certainly stimulate quality, research development and business.

Public Works

Public construction can be used very effectively to eliminate unemployment. Much has been done along this line; much more can be accomplished. It is an economic waste to give money, meals and lodging and get nothing in return. Good sound business judgment would lead all governing bodies to anticipate future construction needs at such a time as the present, and later when business gets above normal, cut such work to the very minimum to accumulate jobs for the next subnormal period.

Tax funds for construction should be raised when business is above normal. Tax rate should, if possible, be lowered during the subnormal period. In other words tax rate would be raised when public construction is heaviest and lowered when construction is lightest. This calls for the increasing of public debt at the present and retiring of bonded debt during the period when business is above normal.

By taking advantage of present low construction costs, reducing welfare doles and producing work for men and local industries, the effect is to keep taxes down.

The city and state should call upon its delinquent taxpayers to supply goods or labor in payment, and combine this with its welfare activities to get something for the taxpayers. They might also try the Guinan plan of issuing scrip to taxpayers in return for a small part of their taxes, the scrip redeemable when paid to labor hired from public welfare rolls. Such plan would create many jobs and at the same time give the taxpayer a direct return on his tax expenditure.

Employment Distribution

If fluctuating business must occur, the damage from it may be materially lessened if every man kept on the job. Rather than reduce numbers of men, the hours of labor should be reduced to correspond with business available. The present mad scramble for the little business available takes the form of cutting prices and cutting costs by cutting labor, making one man at $4.00 do the work formerly done by two men at $5.00 each.

When the money available for payrolls is small, the greatest buying is created by effecting the widest distribution rather than by concentrating the money in the hands of only a part of the people. The best way to prove any theory is to carry it to an extreme. Thus, if all incomes were paid to one individual, he could not use it and would buy for his own needs only while all others could buy nothing, thus there would be no business. On the other hand, if every man received an equal part of the total income, it would be entirely used and there would be a maximum demand for goods.

It would be a serious impediment to the return to normal if some employers should now increase the hours of labor and incomes of their men before providing for those unemployed.

Public works contracts can be made most effective in reducing welfare doles and taxes by providing for restricted hours for all men in order to divide this work among the greatest number.

Unemployment insurance can be desirable only if designed to prevent unemployment.

Conclusions

Unless a general renewal of confidence takes place, unless those with confidence take decisive and prompt action, we may have to wait ("it won't be long now") until most of our clothes, furniture, residences, automobiles, etc., are worn out beyond all possible further use before business can return to normal. Then we must see business rise to another peak to supply the accumulated demand in short time in preparation for another slump.

It is to be hoped that every individual and organization can be induced to center its efforts on the ways and means for ending this depression and setting up the regulatory machinery to prevent another such period.

Chrysotile Asbestos in Canada

THE Canada Department of Mines has recently issued an economic report on the Canadian asbestos industry, by James Gordon Ross. This book of 146 pages describes the various asbestos producing units, particularly in the Tetford Mines district, and also discusses in general the properties and uses of asbestos, with statistical data. The report, No. 707, price 25 cents, can be secured from the Mines Department at Ottawa, Ontario.

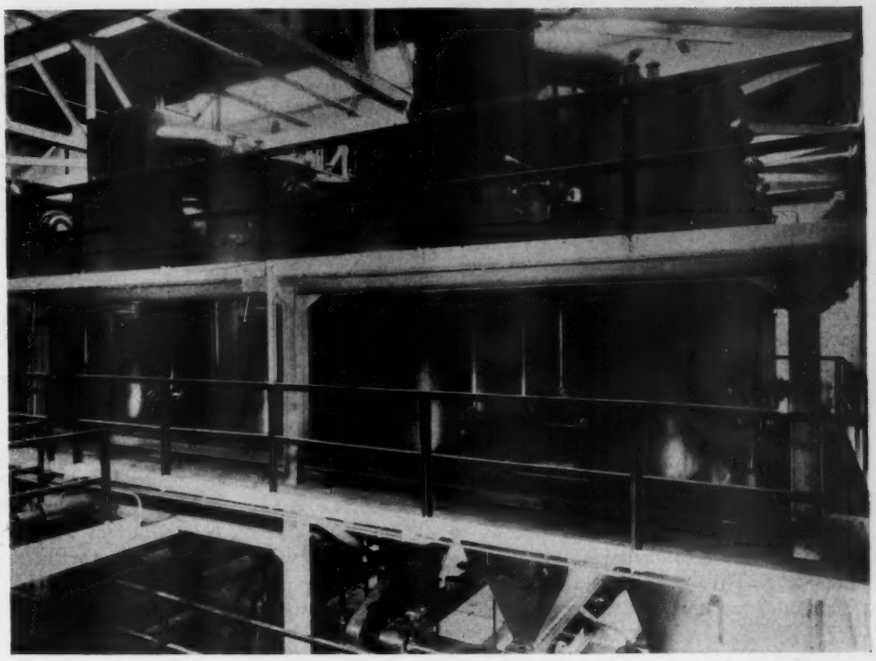
The importance of asbestos in industry is well known but this report brings out the fact that while the tonnage of asbestos produced in a year is comparatively small (in 1930 the tonnage produced in Canada was 242,112 valued at $8,390,163) a far greater tonnage of hard, abrasive rock has to be mined or quarried and processed to produce it so that the industry, though small in ultimate output ranks high in the size of the operations involved.

Kiln Dust Recovery at the Ford Motor Co. Cement Plant

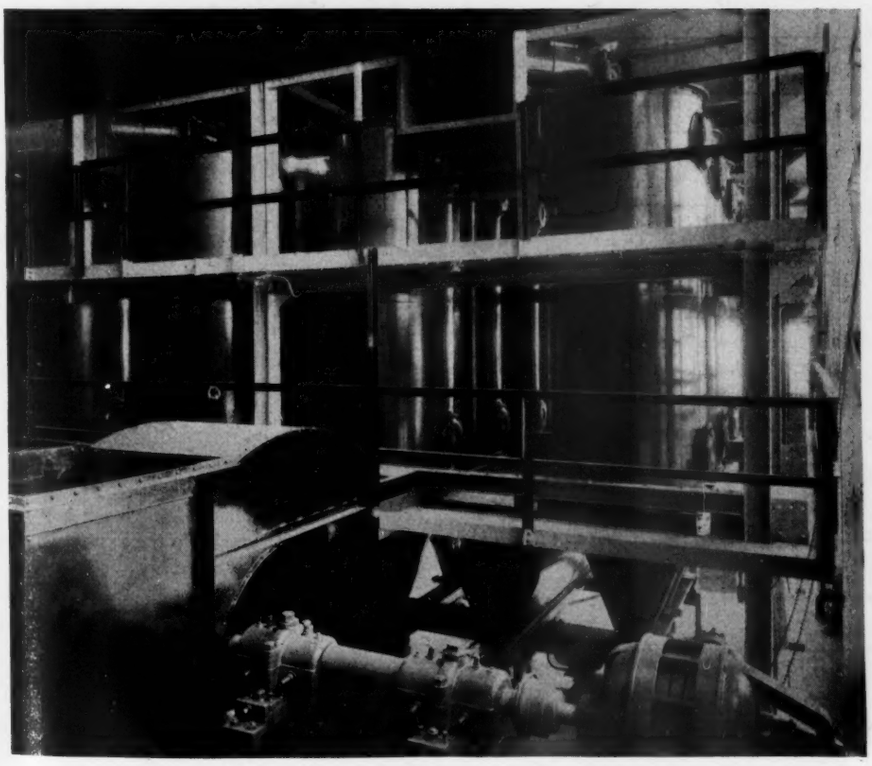
By E. H. de Coningh
Dust Recovery and Conveying Co., Cleveland, Ohio

FROM ITS INCEPTION, the Ford cement plant was designed and has been operated with less regard to conventional practice than to the improvements which sound engineering can bring to cement manufacture from other fields. The Ford plant was the first to use blast furnace slag as raw material for a wet process plant; it was one of the first to use radiant heat from the kilns to dry coal by circulating through the dryers heated air withdrawn from hoods over the firing end of the kilns; and it was one of the first to utilize the slurry filter. Equipment upkeep and a dustless atmosphere within the buildings have set an example for industry, and operating figures have proven that cleanliness and good housekeeping are as profitable as they are desirable.

The single feature of plant operation which was unsatisfactory here was the kiln dust discharge from the stack. The cement plant is located almost in the center of the Rouge group of buildings, and the falling dust was a constant source of complaint from the other departments of the Ford Motor Co. Since it is an absolute requirement that the buildings be maintained clean inside and outside, it became obvious that it was more logical and economical to collect the kiln dust before it left the stack than to wash it up in dilute form after it had precipitated over the rest of the plant.



The upper tier of dust collectors

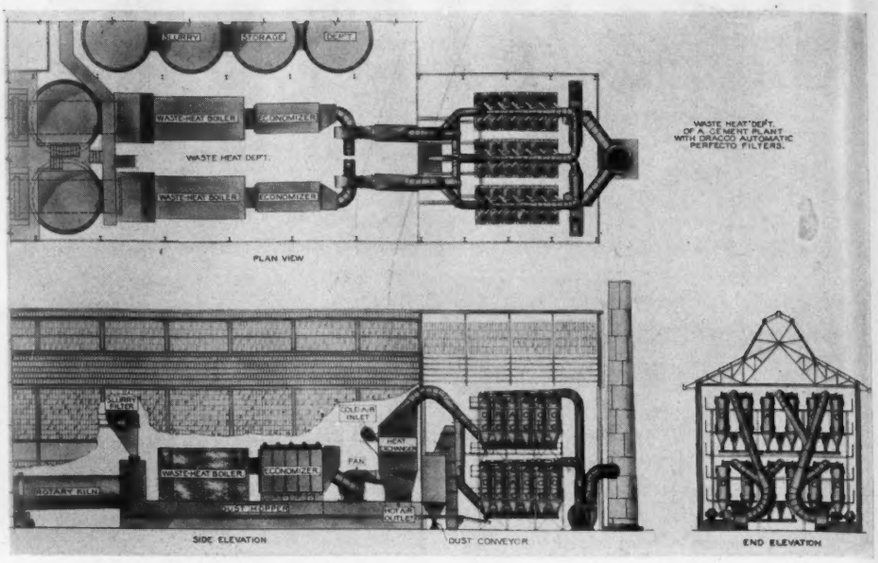


Lower tier of dust collectors, with exhaust fan and motor

So after a thorough consideration of equipment available for filtration of the stack gases and collection of the dust, it was decided to install bag filters. This was a further example of the willingness of the Ford engineers and operators to break away from conventional practice to pioneer in improved methods, since a number of years experience had proven bag filters to be the best equipment for dust and fume recovery throughout the wide group of manufacturing and by-product industries in the range of Ford activities.

A thorough test period following installation of the equipment brought out the fact that the actual filtration of the gases presented no unanticipated difficulties, but the conditioning of the gases between the economizer and the filters required considerable study. There is a relatively high moisture burden from the drying of the filter cake, and this, in company with a high dust load, made a close control of cooling equipment imperative.

The connections to the first heat exchanger were redesigned, and sufficient tests on a portion of the gas flow were made, to draw definite conclusions for the ultimate full load. When it had been clearly demonstrated that successful operation was to be obtained, a new contract was entered into for a larger heat exchanger for this kiln and complete duplicate equipment for the second kiln. One of the illustrations shows the arrangement of the essential parts of the plant to treat the gases leaving the kiln. The actual arrangement differs from this flow sheet only in detail, and the only important feature not indicated is a by-pass connection from the economizer exhaust fan to the stack. The complete equipment for one kiln has been in operation for some time, and the duplicate heat exchanger and filters for the second kiln have been connected.



Layout of collecting system in relation to balance of plant

Table 1 gives the temperature and static pressure readings of the kiln gas from the time it leaves the kiln until it enters the stack, cleaned of its burden of solids, and the chart presents the same data graphically.

Through the waste heat boiler and economizer the temperature is reduced from 1250 deg. to 435 deg. F., accomplishing the generation of sufficient steam to provide power to operate the plant. The temperature of the gas must be further reduced to about 200 to 225 deg. F. before admission to the filter equipment. To accomplish this the gas is exhausted from the economizer through a fan, and directed up through a heat exchanger.

Atmospheric air is forced through the exchanger plates in counter-flow to the gas, entering at 125 deg. F. and leaving at 325 deg. F. The entering temperature of the cooling air is kept at 125 deg. by bleeding some of the 325 deg. heated air in with the current of room air. It is important to avoid any condensation of moisture from the kiln gas, and this is accomplished by distributing the flow evenly, and by maintaining a minimum plate temperature above the dewpoint of the gas.

TABLE 1—KILN GAS TEMPERATURE AND PRESSURE

Location	Temperature in deg. F.	Static pressure in inches of water
Leaving kiln	1250	—0.37
Leaving economizer	435	—3.5
Entering heat exchanger	415	—0.25
Leaving heat exchanger	230	—1.5
Entering filters	227	—2.5
Entering filter exhaust fan	185	—5.62
Entering base of stack	182	—0.5

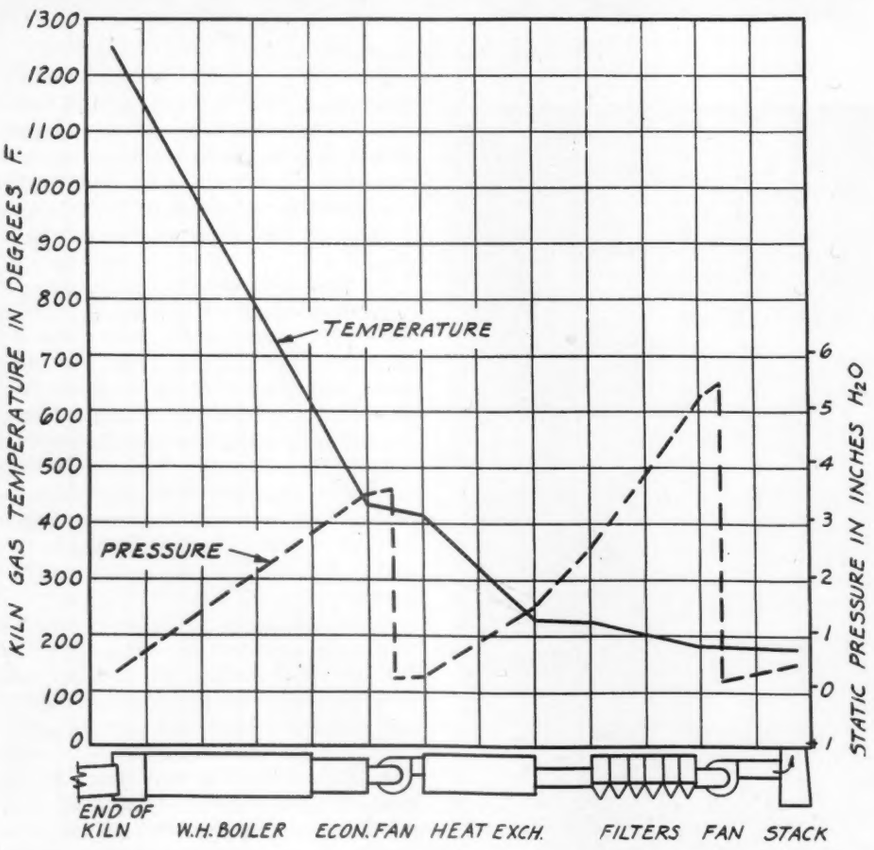


Chart showing temperatures and pressures throughout the collecting system

From the heat exchanger exhaust hood a pipeline leads to the filter building, where the gas is distributed to the three inlet manifolds of the three sets of 12 filter compartments. Pitot tube readings in the pipeline indicate a gas volume of 42,000 cu. ft. per min. at 240 deg. when operating the kiln at a capacity of 1500 bbl. per day. The filter compartments are of standard construction, and each one contains 18 tubes of woolen cloth through the walls of which the gas must pass. The dust which builds up on the inside surfaces is automatically shaken down and collected in one bin by means of a screw conveyor system. The cleaned gases are drawn through an exhaust fan at 185 deg. F. and then discharged to the base of the stack.

In order to maintain uniformity of product, the collected dust is discharged continuously from the collecting bin by a pumping system and is spouted into the kiln feed chute along with the filter cake.

One dust pump delivers the dust to a hopper located above the filter, from which point it is delivered to the kiln feed pipe and there fed along with the filter cake to the kiln. Some of this dust is of course carried out of the kiln by the gases, but after the dust concentration has built up to a certain point a balance is struck, and from then on the

dust recovered, calcuated as clinker, constitutes 2% of the total clinker.

To measure the volume of dust collected in the filters, the pneumatic pump was shut off, and for a three hour period all the material from the collectors was isolated and weighed. The figures showed a recovery from one kiln of a little over 40 tons a day of material which replaces the raw feed.

Table 2 gives the chemical analysis of an average sample of the dust, together with filter cake and clinker analyses. Screen tests show that 93% of the dust passes through a 325-mesh sieve.

Figured in terms of clinker yield, one ton of dust is equivalent to almost one ton of filter cake. This is true when cake being used averages 75% clinker yield. Thus the 40 tons of dust per day replaces 40 tons of the raw material, with the kiln output unchanged, and represents more than 166 bbl. of finished cement.

TABLE 2—ANALYSES OF AVERAGE SAMPLES OF FILTER CAKE, KILN DUST AND CLINKER

	Filter cake	Dust	Clinker
SiO_2	14.40	14.80	20.10
Al_2O_3	4.80	5.90	6.80
Fe_2O_3	2.70	2.30	4.00
MnO	0.53	0.35	0.70
CaO	49.50	49.90	65.20
MgO	2.25	1.81	3.04
SO_3	0.65	7.51	0.20
Total alkali	0.05	2.00	.....
Ignition loss	25.00	15.00	.....

The dust burden in the kiln gas before filtration is stated to be approximately 9.25 grains per cu. ft., and it is understood that 98 to 99% of the burden of solids is removed in the filter equipment. There is a slight dust leakage at the damper which closes off the by-pass connection to the stack, and this dust, plus the small percentage which passes through the filters, is sufficient to produce a slight haze at the top of the stack. This cannot be construed in any way as objectionable, and the operators consider that the former dust nuisance has been completely eliminated. And the elimination of the solids as dust has meant their utilization as raw material—a by-product reclamation of 40 tons a day per kiln to set against the cost and maintenance of the recovery equipment.

Canadian Stone Industry in 1930

THE Canadian stone industry, as a whole, in 1930 included the operations of 510 firms with a total capital investment of $29,661,575, according to a report just issued by the Mining, Metallurgical and Chemical branch of the Dominion Bureau of Statistics at Ottawa. Production during the year was valued at $18,629,944, which included the value of the quarry output and the value added by manufacturing in the secondary stone industry. Salaried employes and wage-earners employed in 1930 numbered 8111 persons and their combined earnings amounted to $8,587,088.

The total imports of stone, including slate, during 1930 were valued at $1,946,486, a decrease of 17.7% below the 1929 importations of $2,365,091.

Exports of stone increased 16.9% to $277,258 as compared with $237,121 for 1929.

EXPORTS FROM CANADA OF STONE, BY KINDS, 1930

Crushed	136,837	235,406
Granite and marble, unwrought	1,768	21,913
Freestone, limestone and other building stone, unwrought	2,149	15,829
Dressed stone of all kinds	.....	4,110
Total	.....	277,258

PRODUCTION OF STONE IN CANADA BY KINDS, SHOWING PURPOSES FOR WHICH USED, 1930

For use as follows:		Granite	Limestone	Marble	Sandstone	Total
Building stone—						
Rough	Tons	13,402	63,625	308	13,950	91,285
	$	149,535	329,013	8,740	118,006	605,294
Dressed	Tons	24,909	49,688	3,386	3,936	81,919
	$	1,189,120	1,416,277	687,115	286,972	3,579,484
Monumental and ornamental stone—						
Rough	Tons	7,378	120	991	.....	8,489
	$	110,285	815	10,690	.....	121,790
Dressed	Tons	2,045	210	.....	.....	2,255
	$	111,504	3,577	.....	.....	115,081
Flagstone	Tons	.....	172	.....	816	988
	$	.....	503	.....	9,897	10,400
Curbstone	Tons	31,617	206	.....	316	32,139
	$	181,846	206	.....	5,845	187,897
Paving blocks	Tons	10,568	.....	.....	.....	10,568
	$	84,194	.....	.....	.....	84,194
Lining open-hearth furnaces	Tons	.....	939	.....	.....	939
	$	.....	1,643	.....	.....	1,643
Chemical—						
Flux in iron and steel plants	Tons	.....	238,567	.....	.....	238,567
	$	.....	197,383	.....	.....	197,383
Flux in smelters	Tons	.....	144,472	.....	.....	144,472
	$	.....	110,724	.....	.....	110,724
Glass factories	Tons	.....	1,046	.....	.....	1,046
	$	.....	1,569	.....	.....	1,569
Pulp and paper mills	Tons	.....	157,253	8,192	.....	165,445
	$	.....	181,908	12,785	.....	194,693
Sugar refineries	Tons	.....	32,153	.....	.....	32,153
	$	.....	29,653	.....	.....	29,653
Other chemical uses	Tons	.....	4,773	.....	.....	4,773
	$	.....	6,512	.....	.....	6,512
Whiting	Tons	.....	72	.....	.....	72
	$	.....	1,338	.....	.....	1,338
Asphalt filler	Tons	.....	16,442	1,500	785	18,727
	$	.....	57,579	15,000	956	73,535
Dusting coal mines	Tons	.....	1,289	.....	.....	1,289
	$	.....	5,800	.....	.....	5,800
Agricultural purposes	Tons	.....	61,884	.....	.....	61,884
	$	.....	181,754	.....	.....	181,754
Poultry grit	Tons	2	530	1,938	.....	2,470
	$	65	5,339	11,264	.....	16,668
Stucco dash	Tons	.....	400	9,182	62	9,644
	$	.....	600	62,298	250	63,148
Terrazzo flooring	Tons	.....	.....	229	4,472	4,701
	$	.....	.....	1,145	4,918	6,063
Rubble and riprap	Tons	302,626	679,995	363	35,367	1,018,351
	$	209,490	460,411	545	36,003	706,449
Crushed stone—						
Concrete aggregate	Tons	512,688	1,368,503	.....	233,913	2,115,104
	$	307,338	1,152,166	.....	164,400	1,623,904
Road material	Tons	271,393	3,547,859	.....	90,993	3,910,245
	$	352,570	2,940,552	.....	141,813	3,434,935
Railroad ballast	Tons	674,504	1,362,477	.....	.....	2,036,981
	$	684,004	990,294	.....	.....	1,674,298
Total	Tons	1,851,132	7,732,675	26,089	384,610	9,994,506
	$	3,379,951	8,075,616	809,582	769,060	13,034,209

Talc and Soapstone in 1931

JUDGING from questionnaires received, the production of talc and soapstone dropped 34% during the past year, with prices holding fairly steady. A few of the producers have a pessimistic outlook for the future, but the majority look for an early revival in 1932. Several stated that they were at present experiencing a revival which in the last few months has been quite pronounced.

Plants operated at about 50% capacity and wages were maintained at the 1930 levels. The average wage cut was less than 2%, as most of the producers have made no reductions, and those that have, indicated cuts of not over 5% in each case. Labor conditions were satisfactory to the employer, and 61% of the 1929 labor requirements were used during 1931.

From expenditures for plant maintenance during 1931 the industry is in excellent condition to take care of future business, as roughly 86% of normal expenditures were made. For the future, expenditures 90% of 1931 are indicated.

PRODUCTION AND VALUE OF TALC AND SOAPSTONE FOR 7-YEAR PERIOD*

	Crude			Sawed and manufactured						Ground			Total		
				Talc			Soapstone								
Year	Short tons	Value	Value per ton	Short tons	Value	Value per ton	Short tons	Value	Value per ton	Short tons	Value	Value per ton	Short tons	Value	Value per ton
1924	5,710	$22,247	$3.90	846	$109,405	$129.00	25,630	$1,288,885	$50.30	171,635	$2,095,019	$11.75	203,821	$3,515,556	$19.00
1925	5,684	24,533	4.33	895	107,691	121.00	.....	.....	.....	175,677	1,879,569	10.70	182,256	2,011,793	11.05
1926	5,988	26,723	4.47	1,528	130,253	87.00	.....	.....	.....	174,052	1,954,018	11.20	181,568	2,110,994	11.50
1927	5,706	25,365	4.43	1,494	111,650	75.00	.....	.....	.....	185,116	2,097,709	11.30	192,316	2,234,724	11.60
1928	6,360	48,031	7.55	936	70,394	75.10	.....	.....	.....	195,680	2,419,569	12.40	202,976	2,537,994	12.50
1929	11,228	87,820	7.82	473	140,928	297.94	.....	.....	.....	210,138	2,416,362	11.49	221,839	2,645,110	11.92
1930	4,972	48,913	9.84	385	90,370	234.73	.....	.....	.....	174,028	1,969,055	11.31	179,385	2,108,338	11.75

*From reports of United States Bureau of Mines.

Rock Products Investigations Conducted by the Bureau of Public Roads in 1931

By F. H. Jackson
Senior Engineer of Tests, Bureau of Public Roads

THE IMPORTANT PLACE occupied by the rock products industries in the production of materials used in highway construction makes it necessary each year for the United States Bureau of Public Roads to devote a very substantial portion of its research facilities to studies of materials and combinations of materials which come under this classification.

In the report of last year a summary was given of the more important research projects being carried on by the bureau at that time. It is the purpose of the present report to give the present status of such continuing investigations as were outlined last year to indicate briefly the conclusions which were drawn relative to projects completed last year, and to describe briefly an additional major project initiated during the year.

Studies of Paving Concrete

This project involved the construction of one-half mile of 9-ft. concrete pavement for the purpose of studying, under actual construction conditions, some of the problems involved in the design of concrete paving mixtures

The results of the investigation were reported at the June, 1931, annual meeting of the American Society for Testing Materials, and were also published in full in *Public Roads,* August, 1931, issue. This project was unique in that it made possible a study of the effects of variations in the workability of concrete on the quality of the pavement slab direct, rather than through the medium of control specimens, as has been the general practice in the past.

The outstanding conclusion reached was that, under the prevailing methods of placing and finishing concrete pavement slabs, the limit of workability on the dry side is apt to be reached when the concrete shows a slump of less than 2 in., and that slabs constructed of such concrete will show lower rather than higher strength than when the concrete is of medium consistency (2-in. to 3-in. slump). This condition is due to the tendency of the drier concrete to honeycomb on placing with resultant lower slab strength.

The recommendations made by the bureau as a result of this study follow:

a—That all specifications for concrete for pavements contain a definite requirement covering consistency. The slump test is recommended for this purpose.

b—That the use of paving mixes showing less than 2-in. slump should be discouraged.

c—That specifications for consistency of paving concrete to be finished by any of the methods now in use be revised when necessary to provide that the concrete have a consistency corresponding to a slump of from 2 to 3 in.

Concrete Bridge Floor Slab Tests

In the December, 1931, issue of *Public Roads* there appears a complete report of the tests of bridge floor slabs which have been under way for some time, in cooperation with the Port of New York Authority. These tests were made primarily for the purpose of determining the effect of materials and methods of placing upon the strength and other properties of bridge floor slabs. The coarse aggregates employed in the test were Haydite (an artificial lightweight aggregate), a round silicious gravel and crushed limestone. The fine aggregates were Haydite and a natural quartz sand. Four different methods of consolidating the concrete in place were studied as follows: (1) hand placing; (2) Vibrolithic process; (3) vibration with an electric vibrator, and (4) vibration with an air hammer. Detailed descriptions of the materials, proportions and methods of placing are given in the report referred to above.

The data obtained from tests for flexural and compressive strength indicate that, in the case of both gravel and crushed stone, all of the mechanical methods of placing resulted in higher strength than in the case of concrete placed by hand. In the case of the Haydite concrete, mechanical methods of placing produced concrete of higher compressive strength than hand placing. However, the effect of vibrating on the flexural strength of Haydite concrete seemed to be somewhat uncertain, due possibly to the tendency of materials to segregate according to their specific gravities when subjected to vibration. Tests also indicate that the increase in flexural and compressive strength, due to mechanical placing, are considerably more marked in the case of the angular aggregate than in the case of the round aggregate. Of the three methods of mechanical placing employed in the tests, the Vibrolithic had the greatest effect on strength.

In order to develop information concerning the effect of aggregates and methods of placing on the bond strength of embedded steel, a rather comprehensive series of bond tests were included in the program. Both plain and deformed bars of two sizes were included in the tests. The principal conclusions were as follows:

The apparent unit bond developed by deformed bars is consistently much higher than that developed by plain bars in the same concrete. This comparison was made at loads at which the first slip was detectable by the apparatus used in these tests. A complete description of the apparatus employed is given in the full report.

Tests also indicate that the size of the bar seems to influence the apparent unit bond. With plain bars the ½-in. size shows higher values than the 1-in. size, while with the deformed bars the reverse is true. In general, bars placed in a vertical position develop somewhat greater bond resistance than bars placed horizontally. Where slip occurred at a comparatively low load, as was true of the plain bars, the aggregate in the concrete did not affect the resistance developed, but where deformed bars were employed the type of aggregate did influence the resistance to a considerable degree. The method of placing used affected the bond resistance, the effect being more marked in the case of deformed bars than in the case of plain bars. The vibratory methods of placing resulted in better bond than was obtained by the hand placing method.

Tests for surface wear and resistance to freezing and thawing were also made in connection with this investigation. The wear tests indicate that for all three aggregates the use of vibratory methods of placing tended to decrease the surface hardness of the concrete. It is believed that the vibration tends to bring water to the surface and that this water carries with it the finer less-resistant particles.

Tests for durability were made by subjecting sawed specimens of concrete to 100 alternations of freezing and thawing. Examination of specimens after completion of the test indicated them all to be in very good condition. Differences in the resistance of various groups, however, were detected and these differences permit some comparison to be made of the effect of the aggregates and methods of placing on resistance to frost action.

It is apparent that the concrete containing silicious gravel was affected least by the repeated freezings. This is probably due to the fact that the concrete containing the limestone coarse aggregate was more difficult to consolidate because of the angularity of the particles. The water-cement ratio was also higher than when the gravel was used and more void spaces appeared around the coarse aggregate particles.

It is indicated that the somewhat greater effect on the limestone concrete was due to the fact that a higher water-cement ratio was necessary to produce comparable workability, rather than to the fact that the limestone was used as a coarse aggregate. It appeared to be true of all the specimens that the least resistant surface was that which was left by the finishing process on the upper surface of the slab.

Other Aggregate Investigations

The bureau has been continuing its studies of factors affecting the durability of concrete, with particular reference to the effect of aggregates. As mentioned in last year's report, the results indicate the necessity of determining definitely in advance of construction whether or not the aggregate proposed for use are of a durable character. Additional data secured during the year also indicates the extreme desirability of limiting the water-cement ratio in concrete to be exposed to the weather.

The bureau has continued its studies of laboratory methods of testing both fine and coarse aggregates. Additional data are being secured relative to the new mortar strength test which was recently adopted as a tentative standard by the A.S.T.M. and which appears to possess some advantages over the Ottawa test long used as a standard measure of the quality of concrete sand. The investigation of the Los Angeles rattler test, used on the Pacific Coast as a measure of the quality of coarse aggregate, has been continued. Considerable data regarding this test and its relation to the standard Deval test have been obtained, and it is hoped that a report will be published in *Public Roads* during the coming year.

Projects Initiated During the Year

As an outgrowth of the concrete paving studies reported last year, the bureau has begun another investigation along the same general lines for the purpose of studying:

(1) The effect on the strength, density and other properties of paving concrete, of the use of a finishing machine equipped with screeds on which are mounted high-frequency electric vibrators.

(2) The effect of manipulating the surface of paving concrete by hand in order to eliminate the excess water used in placing (the so-called "Johnson method" of finishing).

(3) The effect on the workability and strength of paving concrete, of replacing a certain amount of portland cement with hydraulic lime.

A series of 168 pavement slabs each 9 ft. by 9 ft. in size have been constructed for the purpose of studying the above indicated variables. The same types of aggregates were employed as in the investigation reported last year. The slabs will be broken during the spring of 1932 and it is hoped that a report will be available shortly thereafter.

A Superintendent's Analysis

(Contributed)

THIS little corner of the state of California is hopeful that conditions will improve as soon as the country, and it is hoped the assets, also, will thaw out in the spring. A lumber company, erecting a big steel and concrete class A mill a couple of years ago, and then dropping everything before operating or even installing equipment, was a heavy jolt to this community; but it is reported the company is to resume activities in the spring. State highway contracts continue to be awarded, but several contractors have told me lately that competition is getting so keen, profits, if any, are slim indeed.

Of course, as always, with good management, suitable equipment (and deplorable but true sometimes the "breaks") will make a good profit for some concerns where others will lose money.

This summer three resurfacing jobs were let up in the mountains between here and another town. One outfit, fine people, will make it about even. They used an 18-in. by 36-in. jaw and 3-ft. cone crushers, but struck a tough quarry. The second outfit, inexperienced, with the best and biggest of the three jobs, an ideal quarry, shows a loss, it is reported. The equipment was too light. The third concern, experienced and mark this, because the state has a wage scale minimum that the employers cannot go below, has an organization that keeps the men on their toes every instant, and each one knows his job and does it. The equipment, including 24-in. by 36-in. jaw and 4-ft. cone crushers, was set up and the job almost completed by the time the other fellows started crushing. This operator finished his job, got out of the mountains early in the fall, was set up again and producing on a fine big job below the snow line that will keep him going all winter. The "breaks" he got were two quarries of easily worked material—for a 2-ft. crusher.

The manager of a large permanent commercial plant refers to them as "rock-crushing devils." So it does seem to me that on state work at least, the strong, well organized and managed concerns are about the only ones that stand much chance of coming out with a profit.

I know one thing. To keep production costs down we need rugged built, abrasion resisting equipment, and I think the manufacturers that supply that type are the ones that will get the orders.

To sum it all up, with farm produce so low, taxes so terrifically high, trucking concerns taking so much freight from the railroads, besides employing their trucking labor at a reasonable rate, contractors bidding so keenly against each other—how can the state minimum labor scale be kept up in view of so much unemployment? If employers can't make a slight profit, how can there be employment?

But we are trusting that the readjustment will find its level, whether labor gets $8.00 a day and buys on that level, or $5.00 a day and buys on a proportionate level.

Many years ago—I believe Cleveland was running for President—another young fellow and myself bought wood for fuel in the mountains, teamed and sold it in town. After a few years of subcellar prices, the supply fell off a little and we were selling on a rise. Politics waxed hot and I asked my partner which party he favored, and he said he didn't give a ——— so long as the price of wood stayed where it was.

And so we are now hoping there won't be too much overproduction of our product, when a demand does materialize. My belief remains unshaken, that a good product, honestly built or produced and sold at a reasonable price, will eventually win out.

National Sand and Gravel Association Issues New Year Book

THE National Sand and Gravel Association, Washington, D. C., has issued a year book which will be an annual feature of the association.

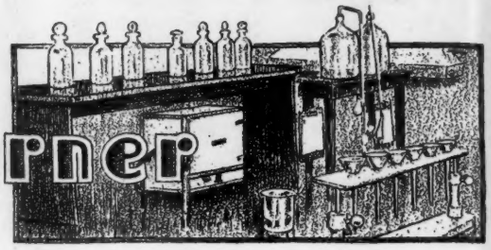
The purpose of the "year book" is to review the accomplishments of the association in the past, to discuss the work at present being undertaken by the association, and to point out what is confronting the industry.

The next issue of the year book will appear about May 1, 1932, and any companies which join the association in the interim will be listed in the coming issue.

The book outlines the purpose of the National Sand and Gravel Association and its various activities. These activities are divided into two broad classifications: those having to do with the administrative, legal and economic phases of the industry, and those dealing with the technology of the production of sand and gravel. The former group come under the supervision of the executive division and the second group under the engineering and research division.

The work of the engineering and research division, including the work of the research laboratory, is briefly explained, which, associated with the technical publications of the association, gives the member reader a definite idea as to what his association is doing. Other typical association activities, such as personal service to members, car supply, freight rate, minimum weights and overloading penalties, cleaning and repairing railroad cars, specifications for gravel ballast, standardization of sizes, and other activities of the association are outlined.

The Chemists' Corner



Byproduct Gypsum as Retarder of Cement Setting

By Katsuzo Koyanagi
Chichibu Cement Co., Ltd., Tokyo, Japan

IN THE MANUFACTURE of double superphosphate, a great quantity of gypsum comes out as a byproduct. As the cement industry is one of the greatest consumers of gypsum, efforts have been made to use this phosphate gypsum as a retarder, instead of natural gypsum, in the manufacture of portland cement. But application of this gypsum to cement is at present troublesome, because this gypsum always contains a certain quantity of phosphoric acid, which is generally believed harmful to cement.

The phosphate gypsum comes from a fertilizer factory in the form of a white powder which contains ordinarily about 98% gypsum (double hydrate) and always more or less water soluble or insoluble phosphoric acid. Some analyses of this gypsum are given in Table I.

TABLE I. ANALYSES OF PHOSPHATE GYPSUM

	No. 1	No. 2	No. 3	No. 4	No. 5 (crude)
H_2O (not comb.)	0.31	0.25	2.88	2.38	.....
Insoluble	0.25	0.20	0.35	0.21	0.61
SO_3	45.60	46.31	44.69	45.95	41.40
Total P_2O_5	0.88	0.41	0.52	0.68	1.84
Water sol. P_2O_5	0.02	0.01	0.01	0.02	0.17

We have carried out in our laboratory extensive experiments on this. First, the effect of phosphate gypsum on the setting and hardening of cement was compared with the use of pure natural gypsum, and then the origin of the effect was microscopically investigated by using pure reagents of phosphoric acid compounds.

Effect of Phosphate Gypsum on the Setting and Hardening of Portland Cement

We made some kinds of gypsum with various contents of P_2O_5 by adding to a natural gypsum a crude phosphate gypsum with a comparatively high content of P_2O_5. The analyses of these gypsums are given in Table II.

These gypsums were then added to cement clinkers and ground in a test mill. The fineness and SO_3 content of the cements were always held the same (SO_3 at 1.2%). The cements thus made were tested for setting time and strengths. Table III shows the results of these tests.

TABLE II. ANALYSES OF MIXED GYPSUMS

	No. 1 (Natural gypsum)	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7 (Crude phosphate gypsum)
SO_3	45.09	44.65	44.18	43.27	42.77	42.13	40.39
Total P_2O_5	0	0.26	0.45	0.75	1.27	1.65	2.60
Water soluble P_2O_5	0	0.01	0.02	0.04	0.10	0.14	0.22
Ammonium-citrate soluble P_2O_5	0	0.02	0.15	0.20	0.57	0.66	0.82

TABLE III. SETTING TIME AND STRENGTHS

Clinker sign	Gypsum No.	Fineness of cement 4900 /cm.² Pct.	Fineness of cement 10,000 /cm.² Pct.	Setting time Initial set hr. min.	Setting time Final set hr. min.	Strengths (1:3) kg./cm.² Tensile strength 3 days	Tensile strength 7 days	Tensile strength 28 days	Compressive strength 3 days	Compressive strength 7 days	Compressive strength 28 days
A	1	4.0	12.6	3 44	5 40	28.3	38.6	40.3	274.0	504.0	629.3
	2	4.0	12.7	4 10	6 15	27.3	38.6	43.0	275.6	482.0	624.6
	3	4.0	12.7	4 15	6 25	28.1	36.6	41.3	290.0	487.0	648.6
	4	4.0	12.7	4 32	6 51	29.3	39.6	45.3	297.0	517.6	638.0
	5	4.0	12.7	5 43	7 50	29.3	37.8	39.5	296.6	493.3	653.3
	6	4.0	12.7	6 32	8 45	30.1	40.6	41.8	290.6	508.6	674.6
	7	4.0	12.7	7 36	9 36	30.6	39.3	39.3	299.0	489.3	606.6
B	1	3.8	11.2	3 14	4 17	35.1	37.8	40.1	383.0	498.0	574.0
	2	3.8	11.2	3 26	4 30	34.5	35.3	40.8	370.6	485.3	570.6
	3	3.8	11.3	3 30	4 48	34.8	38.2	41.6	365.6	446.0	574.6
	4	3.9	11.3	3 49	5 04	34.5	39.2	39.8	356.0	451.0	556.0
	5	3.9	11.3	4 14	5 31	33.3	34.6	40.1	348.6	470.0	540.0
	6	3.9	11.6	4 38	6 00	33.8	36.3	40.5	357.3	485.3	556.0
	7	3.8	11.4	4 50	6 30	33.6	36.5	40.1	358.0	484.0	544.0

We see from this table that the setting time becomes longer with increasing content of phosphoric acid in the gypsum; the strengths of cement A are bettered very much, and those of cement B become a little lower. From this it may be considered that the phosphoric acid in phosphate gypsum retards cement setting very much, though its effect on cement hardening is small.

Origin of Retarding Action of Phosphoric Acid in Phosphate Gypsum on Cement Setting

A. Effect of various calcium phosphates on cement setting.

Phosphate gypsum always contains a certain quantity of P_2O_5 in water soluble, insoluble and ammonium-citrate soluble forms, as shown in Tables I and II. As the phosphoric acid compounds in phosphate gypsum, only the following substances can be considered:

(1) Monocalciumphosphate and free phosphoric acid—water soluble.
(2) Dicalciumphosphate — ammonium-citrate soluble.
(3) Tricalciumphosphate—insoluble.

We carried out some experiments to determine which of these substances retards the cement setting. Pure reagents of the above four compounds were added, always in the same quantity calculated as P_2O_5, to a cement which contained as much gypsum as 1.2% SO_3, and the setting of the cement was tested.

Fig. 1 shows the results of this testing, and the relation between the per cent. of P_2O_5 in the water and the time of initial setting of the cement in hours.

It is to be seen that only water soluble compounds of phosphoric acid, i.e., free phosphoric acid and monocalciumphosphate, have capability of retarding the setting.

B. Effect of monocalciumphosphate on the hydration of portland cement.

In perusal of cement literature no research

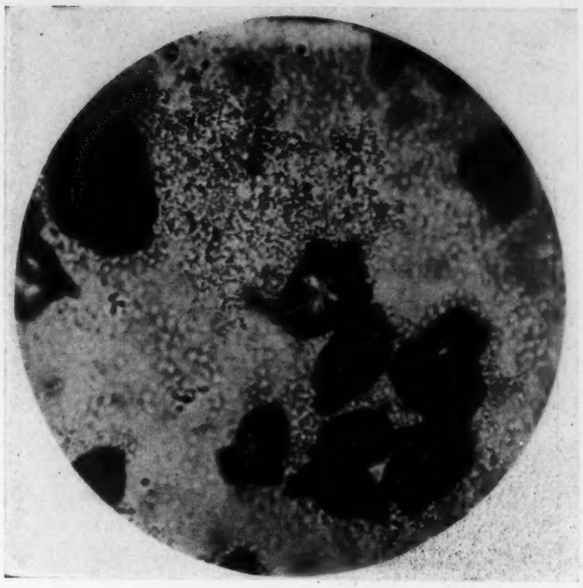


Fig. 2. Flocculent substances formed in hydration of cement with monocalciumphosphate solution

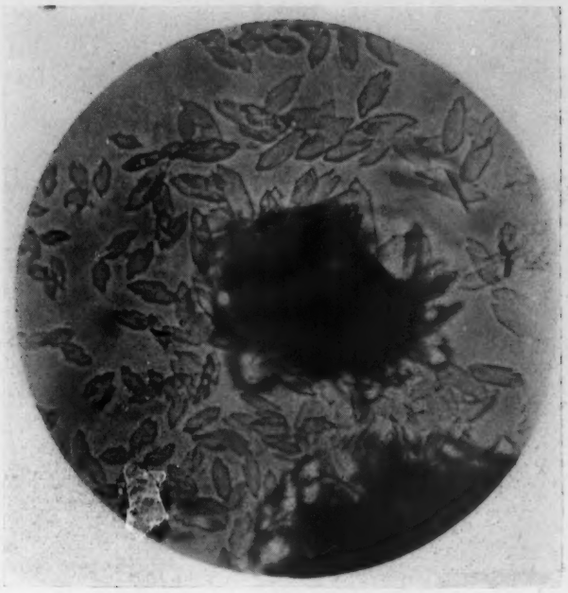


Fig. 3. Hexagonal plate crystals formed with more concentrated solution

on this question can be found. In our experiment the question was treated at first in a physical way, later with microscopical methods.

(*a*) *Physical experiment on the effect of monocalciumphosphate on the hydration of portland cement.*

(1) Effect of monocalciumphosphate on setting of cement.

Small quantities of pure monocalciumphosphate were dissolved in water with which the setting of numerous cements was carried out. Some examples of this testing are given in Table IV.

We can see in this table that a quite small quantity of monocalciumphosphate retards setting very much.

(2) Effect of monocalciumphosphate on hardening of cement.

Some cements of leading factories in Japan were bought on the market and tested for strengths, using ordinary water and 0.05% solution of monocalciumphosphate as mixing water, and the strengths were compared. The results are given in Table V, which shows that the addition of such a small quantity of monocalciumphosphate as 0.05% to the mixing water lengthens the time of initial setting of cements about one hour, while the strengths are not much affected.

TABLE IV. SETTING TIME

Monocalcium-phosphate % in water	Cement No. 1 — Setting time				Cement No. 2 — Setting time				Cement No. 3 — Setting time			
	Initial		Final		Initial		Final		Initial		Final	
	hr.	min.	hr.	min.	hr.	min.	hr.	min.	hr.	min.	hr.	min.
0	4	10	5	38	3	32	4	38	2	49	3	58
0.01	4	41	6	26	3	31	4	41	2	49	3	57
0.02	4	52	6	37	3	33	5	03	2	51	4	11
0.03	4	56	6	54	3	39	5	25	2	59	4	17
0.04	5	00	7	00	3	44	5	40	3	11	4	18
0.05	5	11	7	12	4	00	5	51	3	16	4	20
0.10	5	12	7	14	4	11	6	01	3	27	4	42
0.30	6	54	9	02	4	44	6	22	3	49	5	19
0.50	7	58	10	03	5	06	6	46	4	34	5	48
0.70	8	16	10	22	5	21	7	14	5	05	6	15
0.90	9	14	11	44	5	33	7	35	5	20	6	35
1.20	10	25	12	50	6	36	8	45	5	37	7	12

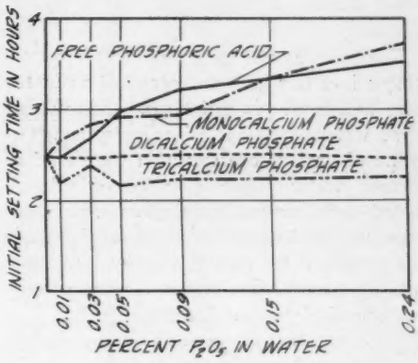


Fig. 1. Relation between phosphorus pentoxide in water and time of initial set

(*b*) *Microscopical experiment on the effect of monocalciumphosphate on the hydration of portland cement.*

A new investigation by the writer on the hydration of portland cement led to the conclusion that the setting of well-burnt portland cement is chiefly carried out by the formation of needle and hexagonal plate crystals of calciumaluminate, while the hardening is carried out mostly by the formation of gel—substance of calcium-hydro-silicate. With this investigation as a basis the writer

TABLE V. SETTING TIMES AND STRENGTHS

(Cement A, B, C, D, E, F, G—portland cement; H and I—mixed cement)

Signs of cement	Fineness of cement 4900 /cm.²	10,000 /cm.²	Test with ordinary water — Setting time — Initial hr.	min.	Final hr.	min.	Tensile strength (1:3) kg./cm.² 3 da.	7 da.	28 da.	Compr. strength (1:3) kg./cm.² 3 da.	7 da.	28 da.	Test with 0.05% solution of monocalciumphosphate — Setting time — Initial hr.	min.	Final hr.	min.	Tensile strength (1:3) kg./cm.² 3 da.	7 da.	28 da.	Compr. strength (1:3) kg./cm.² 3 da.	7 da.	28 da.
A	2.2	9.86	2	57	4	07	33.3	38.8	44.8	356.0	497.6	659.3	3	50	5	20	34.5	38.5	44.1	367.6	493.6	642.6
B	1.6	8.40	2	51	4	03	33.8	34.8	39.6	439.0	481.6	592.0	3	30	5	10	31.3	35.6	40.0	450.3	498.0	585.3
C	2.6	8.00	3	42	5	02	33.0	38.3	44.1	360.7	492.0	612.0	4	40	6	08	33.3	38.3	43.0	366.7	489.6	604.0
D	3.5	11.36	3	23	4	35	32.8	36.1	41.0	378.0	481.0	544.6	4	10	5	38	34.0	36.5	41.1	360.3	471.6	591.3
E	3.2	10.20	3	35	4	40	26.1	34.0	40.3	290.0	425.3	523.0	4	45	5	55	29.5	31.3	42.3	291.0	418.3	517.0
F	9.2	19.40	3	02	4	09	32.1	34.8	39.5	338.3	438.7	541.3	3	48	4	56	30.3	35.2	41.3	330.6	433.3	549.3
G	4.8	13.60	3	09	4	45	28.8	33.8	41.6	327.3	440.0	524.6	3	25	4	57	26.6	33.0	38.0	338.0	446.3	520.6
H	1.64	6.96	5	15	6	55	23.6	31.3	42.8	229.0	357.0	524.0	6	35	8	00	25.5	32.3	41.6	221.6	360.0	529.3
I	0.75	3.20	4	00	5	15	33.1	38.5	49.0	386.6	542.6	662.0	5	00	6	27	33.6	40.6	51.5	.....	521.6	659.6

Fig. 4. Rhombic crystals of monocalciumphosphate

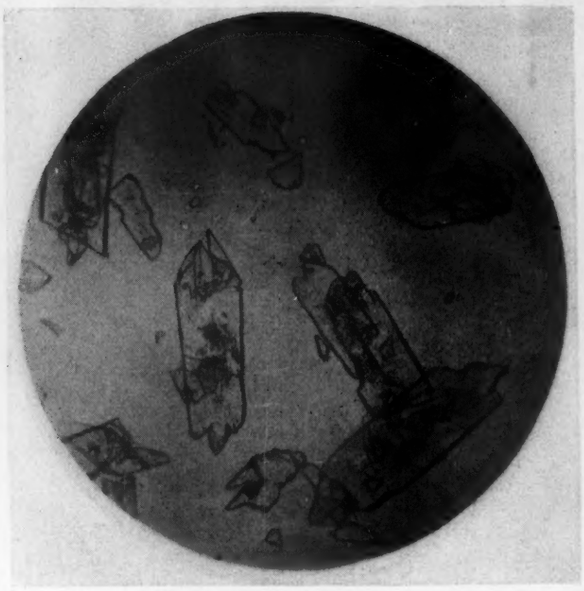


Fig. 5. Hexagonal crystals of dicalciumphosphate

has further experimented to determine the effect of monocalciumphosphate on the hydration of portland cement.

The samples and specimens for the microscopic investigation were prepared as in the aforementioned investigation. Instead of pure water, solutions of monocalciumphosphate of various concentration were used as mixing water. The quantity of solution added to the cement in the microscopic specimens was held for all specimens at five times the weight of the cement samples. As samples, very hard burnt cement clinkers of normal chemical composition were used.

(1) Observation of specimens during hydration of cement clinker.

As it was shown in the afore-mentioned investigation on the hydration of portland cement, the hydration of well-burnt portland cement clinker without gypsum begins under any circumstance, with the formation of thick short needle crystals of calciumaluminate, which transform later into thin hexagonal plates.

In the hydration of cement clinker with monocalciumphosphate solution, soon after adding, sea-weed-like flocculent substances appeared around the clinker particles (Fig. 2). When the concentration of the monocalciumphosphate in the solution exceeds 0.10-0.30%, a great number of long hexagonal plate crystals, instead of the above mentioned flocculent substance, appeared soon after mixing (Fig. 3).

After some time the formation of calciumaluminate crystals began, which became later and later with increasing concentration of monocalciumphosphate solution. All other hydration products which appear in the hydration of cement clinker with pure water appeared also in this case, but their time of formation was more or less delayed.

For each clinker sample we prepared 10 specimens with solutions of various concentration from 0.01 to 0.09%, and measured the time of formation of all hydration products. We could determine that the formation of calciumaluminate and lime-hydroxide-crystals are very much delayed with increasing concentration of monocalciumphosphate solution, while the formation of gel-substance of calcium-hydro-silicate is not so much influenced as the afore-mentioned substances.

(2) Determination of the chemical composition of the new formations which appear in the hydration of cement with monocalciumphosphate solution.

The new formations which appear in the hydration of cement with monocalciumphosphate are sea-weed-like flocculent substances and long hexagonal plate crystals. Both substances did not appear in the hydration of cement with pure water. The ingredients of portland cement clinker which have the possibility of reacting with monocalciumphosphate are as follows:

(1) Lime which exists in clinker in a free state, or is set free by the hydration of calciumsilicate in cement.
(2) Calciumaluminate.
(3) Calciumsilicate.

Reaction Between Monocalciumphosphate and Lime

There are three compounds of calciumphosphate: monocalciumphosphate, $CaH_4(PO_4)_2 H_2O$, which belongs to the rhombic crystal system; dicalciumphosphate, $CaH\cdot PO_4\cdot 2H_2O$, which belongs to the hexagonal crystal system; and tricalciumphosphate, $Ca_3(PO_4)_2$, which belongs to the amorphous system.

A small quantity of these compounds was taken on glass and observed under the microscope. Fig. 4 shows rhombic crystals of monocalciumphosphate, Fig. 5 shows hexagonal crystals of dicalciumphosphate and Fig. 6 shows amorphous substance of tricalciumphosphate.

Monocalciumphosphate combines with one molecule of lime and forms dicalciumphosphate. It combines also with two molecules of lime and then forms tricalciumphosphate. These chemical reactions take place very quickly and go on as follows:

$CaH_4(PO_4)_2\cdot H_2O + CaO + 2H_2O = 2\ (CaH\cdot PO_4\cdot 2H_2O)$.

$CaH_4(PO_4)_2\cdot H_2O + 2CaO = Ca_3(PO_4)_2 + 3H_2O$.

When a small quantity of pure CaO was treated with a comparatively dilute monocalciumphosphate solution (under 0.05%) amorphous substances appeared directly after mixing (Fig. 7).

When concentration of the solution exceeded 0.1%, then long hexagonal plate crystals appeared (Fig. 8).

Both these substances are quite the same substances as appeared in the hydration specimens of cement with monocalciumphosphate solution. The amorphous substance must be tricalciumphosphate, and the long hexagonal plates must be dicalciumphosphate.

Thus the chemical composition of new formations which appeared in the hydration of cement with monocalciumphosphate are determined as:

(a) Amorphous flocculent substance is tricalciumphosphate.

(b) Long hexagonal plate crystals are dicalciumphosphate.

Effect of Monocalciumphosphate on Calciumaluminate

It was shown in the preceding paragraph that the formation of calciumaluminate crystals are very much delayed by monocalciumphosphate. In order to determine the origin of this phenomenon we treated an artificial melt of tricalciumaluminate with monocalciumphosphate solution. The hydration of tricalciumaluminate with pure water begins with the formation of thick, short needle crystals which transform afterwards into thin hexagonal plates.

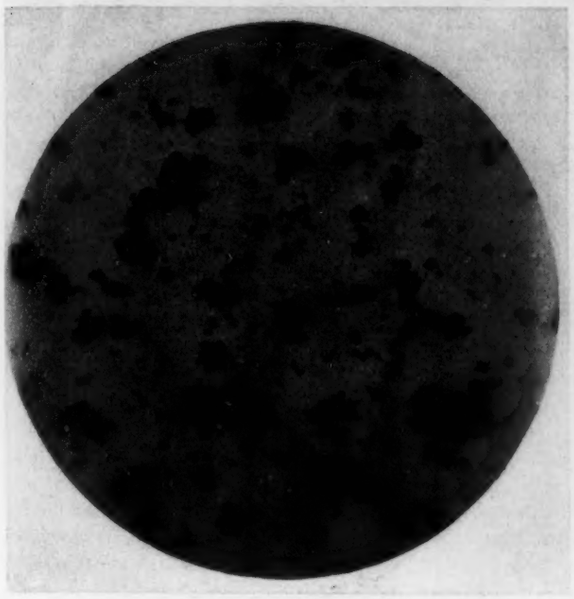


Fig. 6. Amorphous substance of tricalcium-phosphate

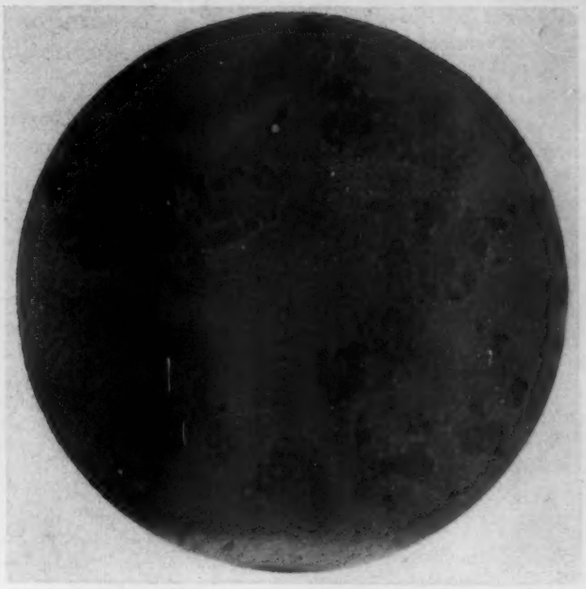


Fig. 7. Amorphous substance formed by treating pure calcium oxide with dilute monocalcium-phosphate solution

In the addition of monocalciumphosphate solution the regular hydration of tricalcium-aluminate ceased completely, and after about two weeks there appeared much drop-formed gel-mass (Fig. 9) which was determined, by dyeing with dyestuff, to be aluminumhydroxide.

From this it can be considered that the monocalciumphosphate reacts on the tricalciumaluminate slowly and forms tricalciumphosphate and aluminumhydroxide:

$$2(3CaO\cdot Al_2O_3) + 3CaH_4(PO_4)_2 = 3Ca_3(PO_4)_2 + 4Al(OH)_3$$

In the hydration of cement a great quantity of lime comes into the solution, which reacts with monocalciumphosphate very quickly, as shown in the previous paragraph, and changes it all into tricalciumphosphate. When the quantity of monocalciumphosphate in the solution is small, it has no chance to react on the calciumaluminate of the cement; but when an excess of monocalciumphosphate exists in the solution it disturbs the hydration of calciumaluminate and the setting of the cement is delayed.

Effect of Monocalciumphosphate on Calciumsilicate

When monocalciumphosphate solution was added to the artificial melts of dicalcium- and tricalcium-silicate, there appeared, directly after adding, an amorphous mass of tricalciumphosphate and long hexagonal crystals of dicalciumphosphate in quite the same way as in cement clinker. The gel substance of calcium-hydro-silicate appeared also in large quantity, only its formation was a little delayed. The formation of crystals of lime hydrate was very much delayed.

The lime which is produced by the hydration of calciumsilicates reacts on the monocalciumphosphate and changes it into inactive tricalciumphosphate.

The writer has also carried out many experiments on the effect of free phosphoric acid on the hydration of cement, and determined that the effect of free phosphoric acid is quite the same as that of monocalciumphosphate.

Fig. 8. Hexagonal crystals formed by stronger monocalciumphosphate solution

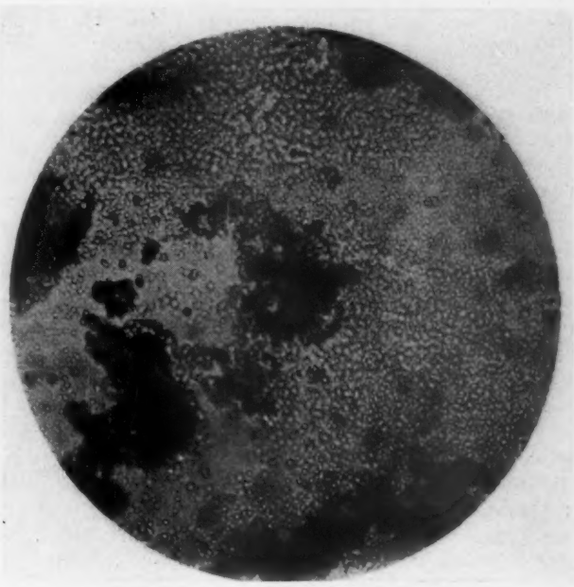


Fig. 9. Gel-mass of aluminum hydroxide formed later

Improvement of Phosphate Gypsum by Chemical Treatment

It has been shown above that the water soluble phosphoric acid contained in phosphate gypsum in quite a small quantity retards the cement setting very much, though its effect on the cement hardening is not so great.

In order to improve the phosphate gypsum, further experiments were carried out. First the phosphate gypsum was washed with pure water many times, but this brought no success, as there remained always some soluble phosphoric acid.

The gypsum was then treated with hot water containing some lime and let stand some time, then filtered and washed again with pure water and dried in the open air.

The analysis of the gypsum before and after treatment is given in Table VI.

TABLE VI. ANALYSIS OF PHOSPHATE GYPSUM BEFORE AND AFTER CHEMICAL TREATMENT

	Before treatment		
Gypsum	No. 1	No. 2	No. 3
SO_3	44.65	44.18	40.39
Total P_2O_5	0.26	0.45	2.60
Water sol. P_2O_5	0.01	0.02	0.22
	After treatment		
Gypsum	No. 1	No. 2	No. 3
SO_3	44.48	44.38	41.20
Total P_2O_5	0.26	0.46	2.66
Water sol. P_2O_5	0.00	0.00	0.02

These gypsums were ground together with a cement clinker in a test mill and tested for setting time. Table VII shows the results of this test.

TABLE VII. SETTING TIME

	Setting time before treatment	
Gypsum	Initial	Final
Natural gypsum	4 hr. 4 min.	5 hr. 35 min.
No. 1	4 hr. 20 min.	5 hr. 46 min.
No. 2	4 hr. 31 min.	5 hr. 49 min.
No. 3	5 hr. 15 min.	6 hr. 45 min.
	Setting time after treatment	
Gypsum	Initial	Final
Natural gypsum	4 hr. 4 min.	5 hr. 35 min.
No. 1	4 hr. 00 min.	5 hr. 35 min.
No. 2	4 hr. 00 min.	5 hr. 40 min.
No. 3	4 hr. 15 min.	5 hr. 50 min.

Conclusion

The water soluble phosphoric acid in phosphate gypsum, though its content is quite small, disturbs the hydration of calcium-aluminate, which is the principal factor of cement setting.

The lime which exists in cement in a free state, or is set free by the hydration of calciumsilicate, reacts with water soluble phosphoric acid very quickly, changes it into inactive tricalciumphosphate, so that the water soluble phosphoric acid, as long as its quantity in gypsum is not great, exerts practically no influence upon the formation of calciumsilicate gel, which is the principal factor of cement hardening.

If the water soluble phosphoric acid in the phosphate gypsum be made insoluble by chemical treatment, then the phosphate gypsum can be used as mixing gypsum in the manufacture of cement quite the same as natural gypsum.

Separation of Calcium and Magnesium by Molybdate Method

THE ordinary methods of separating calcium and magnesium in analysis are accurate but time consuming. R. C. Wiley, University of Maryland, gives a shorter method in a recent issue of *Industrial and Engineering Chemistry*. The calcium is precipitated as a molybdate and filtered and washed and the magnesium is precipitated with ammonium phosphate in the usual way. Calcium molybdate has been found to be quite insoluble in neutral or nearly neutral solutions, while magnesium molybdate is quite soluble in water.

Tests were run on solutions with known contents of calcium chloride and magnesium nitrate and results were checked both by the known content and the usual permanganate method. The solution of mixed salts was heated to boiling, a drop or two of ammonium hydroxide added and the molybdate solution at one drop a second until there was an excess. The solution was then boiled until clear and allowed to cool. Then the precipitate was filtered off in a tarred Gooch crucible with ordinary asbestos reinforced with a little ground asbestos. It was given 10 washes of hot distilled water of about 10 c.c. each. The crucible was dried at 130 deg. C. for 30 m. and then ignited and weighed. The filtrate, 100 to 125 c.c. in bulk, was used for determining magnesium without evaporation, in the usual way, by precipitating as magnesium ammonium phosphate, filtering in a Gooch, igniting and weighing as magnesium pyrophosphate. The procedure for an acid solution was the same except that a slightly acid solution of ammonium molybdate was used and no ammonium hydroxide was added.

Tables of results show very close checking of this method with the known contents and also with the results found by the usual method.

Discussing the manipulation, the author says that the calcium molybdate is dense and hard and settles quickly and is easily washed and filtered. A stirring rod should not be left in the beaker, for crystals appear where the beaker is scratched and they are hard to rub off with a policeman. The precipitate may not appear immediately and the first precipitate is rather soluble, but after boiling 10 to 15 min. it becomes highly insoluble. Sometimes the precipitate is not pure calcium molybdate, but it is converted to calcium molybdate on ignition in a Gooch. The precipitate must not be ignited in a filter paper because it will be reduced. The Gooch may be used over and over again.

If the molybdate solution is added too rapidly the crystals tend to stick to the sides of the beaker. They may be removed by a horn spatula or by rubbing a crystal of ammonium chloride against them with a policeman. Like other molybdates, this precipitate is soluble in strong mineral acids and strong bases so the solution from which it is precipitated should be nearly neutral. The author says he prefers to have the solution slightly alkaline. Reducing gases should not come in contact with the precipitate during ignition. A large excess of molybdenum solution should be avoided. A drop of the solution should be tested before filtering with a solution of pyrogallol in chloroform. A brown color shows excess, but this is not decisive unless the solution has been boiled at least 10 min.

A Study of Fine Grinding

IN AN ADDRESS before the (British) Ceramic Society, Leonard Andrews describes closed-circuit grinding of flint for making pottery. It appears that this is comparatively new in European practice, the usual method being to batch grind in closed tube mills, sometimes called processing. The feature of the new method most interesting is a new centrifugal classifier. The pulp is pumped from a wash tank in which it has been thoroughly mixed and enters a cone through a tangential pipe in the upper part. This gives a swirling motion, carrying the heavier particles away from the center. These sink down the sides. The fines go into a distributor cone which hangs from the short end of a siphon pipe that dips down into the cone. There is an outer cone that acts as a guide, and radial blades between the two destroy the swirl. The oversize particles slide down the sides of the cone to a spigot at the bottom of the classifier. The size of the particles in the overflow is determined by the amount of pulp that is being fed to it and the amount discharged through the spigot. The author says that the lift of the siphon takes the pressure off the spigot, so presumably the discharge is thickened as in other cones of this type.

A plant in the north of France is described as having calcining kilns, a preliminary crusher and tube mills in closed circuit with a centrifugal classifier, a thickener for the overflow, and a rotary filter to make it into a cake. The author of the article, Mr. Andrews, believes that such plants will become common, relieving the pottery manufacturer from maintaining a grinding plant section.

The paper is illustrated with graphs of the products from batch grinding flint in a pan mill, giving the sieve analyses of samples taken at 2-hr. intervals for 8 hr. The feed had 2% of minus 200-mesh, which was increased to 56.4% by the first 2-hr. grinding, and 30.4% of this was finer than 0.01 mm. After 4 hr. the minus 200-mesh is increased to 70.6% and the 0.01 mm. to 56.1%. But after the 8-hr. grinding the minus 200-mesh is 84.5% and the 0.01 product 61.4%, and the author says that this is about as far as the grinding could be carried by batch grinding, as further grinding would not increase the 0.01 product. This seems to show that more effective work could be done by removing the fines as they are produced.

Nova Scotia's Only Hydrated Lime Plant

WINDSOR, NOVA SCOTIA, is known throughout the rock products world as the center of a large gypsum producing section but it is not generally known that near this town is a lime plant. Although small, this limestone and lime-burning operation is interesting and shows what can be done in a sparsely settled district, where new building is practically negligible, by taking advantage of all possible market outlets for lime.

The Eastern Lime Co., Ltd., at Windsor supplies limestone for soil correcting purposes, but also produces lime for use

One end of quarry

in the manufacture of insecticides and fungicides for the Canadian agriculturist.

Nova Scotia is famous as an apple producing section, most of which centers in the Annapolis valley. The large and prolific orchards in that section ship their products to Canadian markets as well as to the British Isles. It is for the control of harmful insect life and fungi that part

New Canadian National Railways depot and hotel at Halifax

of the products put out by the Eastern Lime Co., Ltd., were developed.

Lime is also produced for use in mortars in building work. The new railway depot and hotel of the Canadian National Railways at Halifax, the Mersey River Paper Mills and other buildings of importance were built with mortar which contained lime that was produced at this operation.

The limestone deposit is a highly fossiliferous material. The fines are loaded into carts as indicated in one of the illustrations and hauled to the pulverizing plant for the production of agricultural limestone. This material is crushed down to about ¾-in., pulverized to 1/10-in. and under and stored in an enclosed circular-shaped, wooden structure which protects it from the weather. Reclaiming is by hand.

The coarser material in the quarry is sent to the kiln for burning. Since only a limited tonnage of burned lime is marketable, it was essential that plant investment be kept at a minimum, and H. C. Burchell, owner, has shown much resourcefulness in this. The burning plant consists of one vertical kiln which is made up simply of an old masonry field kiln as a base, and a gypsum calcining kettle above that, while the upper portion of the kiln had at one time functioned as part of a

Hydrating plant with kiln at right

steam boiler. Mr. Burchell says that the metal in the kiln represents an investment of only $23. Coke is used as fuel and is fed at the top of the kiln along with the raw rock.

The burned lime is hydrated in a Clyde batch hydrator located in an adjoining building and after being hydrated it is pulverized and finished to 200-mesh in a Raymond pulverizer and air separation system. The hydrating plant is electric driven throughout. This hydrated product is the base of most of the insecticides and fungicides produced and to it is added various chemicals. The ingredients are mixed in a Broughton mixer and the product is then packed in bags.

Mr. Burchell is assisted in the management by his daughter, Miss Alida Burchell, who is also interested in the management of farm lands and orchards nearby.

Pulverized limestone storage in an apple orchard

Hints and Helps for Superintendents

Power Formulae for Chain Conveyors and Elevators

By Link-Belt Co., Chicago, Ill.

THE INFORMATION given below on the turning efforts, coefficients of friction, chain stresses and horsepower of chain conveyors and elevators should be of value to superintendents and operating men as well as engineers.

In connection with the illustration at right, the letters and characters used in the formulae have the following definitions:

α = Angle of inclination of conveyor or elevator.
B = Bending moment for head shafts in inch pounds.
C = Additional pull to drag buckets through elevator boot.
D = Diameter of chain roller.
d = Diameter of chain pin.
F = Coefficient of sliding friction between chain or wearing shoe and track. See table which follows for values.
F_1 = Coefficient of sliding friction between material conveyed, such as coal, sand, etc., and the conveyor trough. See table.
RF = Coefficient of rolling friction. See table.
J = Weight of moving parts of conveyor or elevator, such as chains, wheels, buckets, flights, etc., which are supported by the head shaft. See wheels 2 of illustration.
J_1 = Weight of driving wheel, gear or pulley on head shaft, with such of the chain or belt as is supported by this "wheel 1" of illustration.
L = Length of conveyor or elevator from head shaft to foot shaft, in feet.
P = Load or resistance to turning, measured in pounds, at the pitch radius of head sprocket or sprockets, which must be balanced by pull of driving mechanism.
P_1 = The equivalent pull necessary at pitch radius of the driving wheel, gear or pulley on this head shaft.
T = Torsional moment for head shafts in inch pounds.
W = Weight of chain and flights, pans or buckets per foot.
W_1 = Weight of material, such as coal, sand, etc., per foot of conveyor or elevator.

Turning Efforts

Vertical Elevators

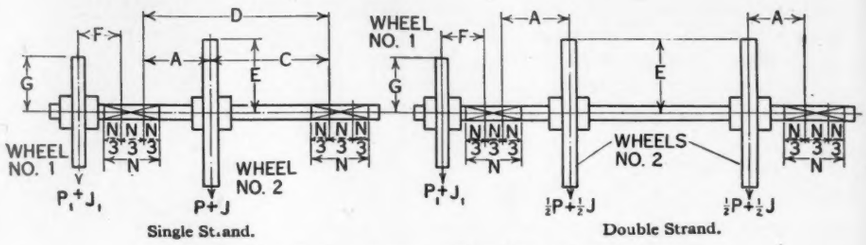
$$(a)\quad P = (W_1 \times L) + C$$

Horizontal Scraper Conveyors
With chains and material sliding

$$(b)\quad P = (2 \times W \times L \times F) + (W_1 \times L \times F_1)$$

Horizontal Scraper Conveyors
With roller chains supporting flights, and material sliding

$$(c)\quad P = (2 \times W \times L \times RF) + (W_1 \times L \times F_1)$$



Illustrating factors upon which formulae is based

Horizontal Conveyors
Which carry the material

$$(d)\quad P = (2 \times W + W_1)\ (L \times RF)$$

Inclined Scraper Conveyors
With chains and material sliding

$$(bb)\quad P = (W \times L)\ (F \times Cos\ \alpha + Sin\ \alpha) + (W_1 \times L)\ (F_1 \times Cos\ \alpha + Sin\ \alpha) + (W \times L)\ (F \times Cos\ \alpha - Sin\ \alpha)$$

Inclined Scraper Conveyors
With roller chains supporting flights, and material sliding

$$(cc)\quad P = (W \times L)\ (RF \times Cos\ \alpha + Sin\ \alpha) + (W_1 \times L)\ (F_1 \times Cos\ \alpha + Sin\ \alpha) + (W \times L)\ (RF \times Cos\ \alpha - Sin\ \alpha)$$

Inclined Conveyors
Which carry the material

$$(dd)\quad P = L\ (W + W_1)\ (RF \times Cos\ \alpha + Sin\ \alpha) + (W \times L)\ (RF \times Cos\ \alpha - Sin\ \alpha)$$

Coefficients of Friction F, F_1 and RF

Sliding Friction

$F = 0.33$ for metal on metal.
$F_1 = 0.59$ for bituminous coal on metal.
$= 0.33$ for anthracite coal on metal.
$= 0.355$ for coke on metal.
$= 0.53$ for moist ashes on metal.
$= 0.60$ for dry sand on metal.
$= 0.585$ for limestone on metal.
$= 0.325$ for shelled corn on metal.

Rolling Friction

$$RF = X \times \frac{d}{D}$$

When $X = 0.5$ for iron pin in cored roller, not oiled.
$= 0.33$ for iron pin in cored roller, greased.
$= 0.25$ for steel pin in bored roller, greased.
$= 0.20$ for steel pin in bored roller, well oiled.

The equations for horizontal conveyors are simple, and need no further explanation. The following example illustrates the procedure to determine turning effort or pull for an inclined apron conveyor.

Example—Determine the turning effort for an apron conveyor 164 ft. centers having an inclination of 23 deg. The weight of the carrier empty is 92 lb. per ft., and the weight of the material handled is 200 lb. per ft. The chains have 6 in. diameter enclosed-oiling rollers, turning on 1½-in. bushings. Then $L = 164$, $\alpha = 23$ deg., Sin 23 deg. $= 0.39$, Cos 23 deg. $= 0.92$, $W = 92$, $W_1 = 200$,

$$RF = 0.20 \times \frac{1.5}{6} = 0.05.$$

The turning effort necessary to operate conveyor, figured from the equation given for roller chain conveyor which carries the material (formula "*dd*"), is:

$P = 164\ (92 + 200)\ (0.05 \times 0.92 + 0.39) + (92 \times 164)\ (0.05 \times 0.92 - 0.39)$.
$P = 47888 \times 0.436 - 15088 \times 0.344$.
$P = 20879 - 5190 = 15{,}689$ = The torsional effort or pull acting at the radius of the sprocket wheels.

Horsepower

To the turning effort just given, 10% should be added for the friction of the head and foot shafts and 15% for each pair of gear reductions for the gross turning effort. Provision should also be made for excessive starting loads.

The necessary horsepower can be computed from the equation:

$$\text{Horsepower} = \frac{\text{Gross turning effort} \times \text{speed in ft. per min.}}{33{,}000}$$

Chain Stresses

In the case of vertical elevators with single chain, the stress in chain equals the turning effort P plus the weight of one run. For double strand chains the stress in each chain equals one-half of this.

In the case of horizontal conveyors the chain stress equals the turning effort or pull only, in a single strand conveyor; and one-half this amount for each chain in a double strand conveyor.

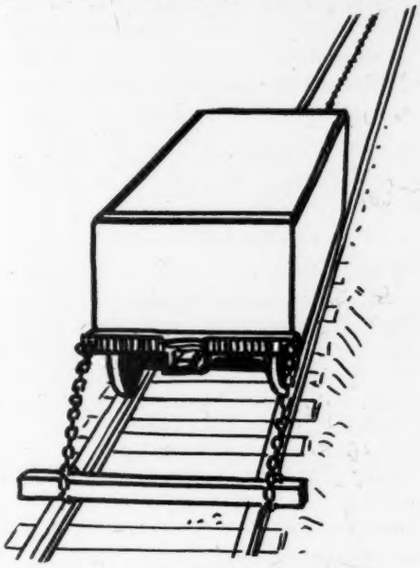
For inclined conveyors the chain stress at head equals the pull due to weight of the carrying run, plus the pull due to weight of material on the conveyor, provided the incline of the conveyor is sufficient to cause the return to move down the incline by grav-

ity. If the incline is insufficient, and the foot wheels have to pull the return run of conveyor down the incline, this pull must be added to the above forces.

In the case of the example given, the total chain stress at head equals 20,879 lb., while the torsional pull amounts to 15,689 lb.

Safety Stop for the Quarry Car

WHERE ROCK is hauled up an incline from the quarry it is not unusual for the car to break loose from the cable. The cause may be breaking of the king bolts or



Stops car from rolling down incline

the slipping of the wire loops from the bolts, or other cause.

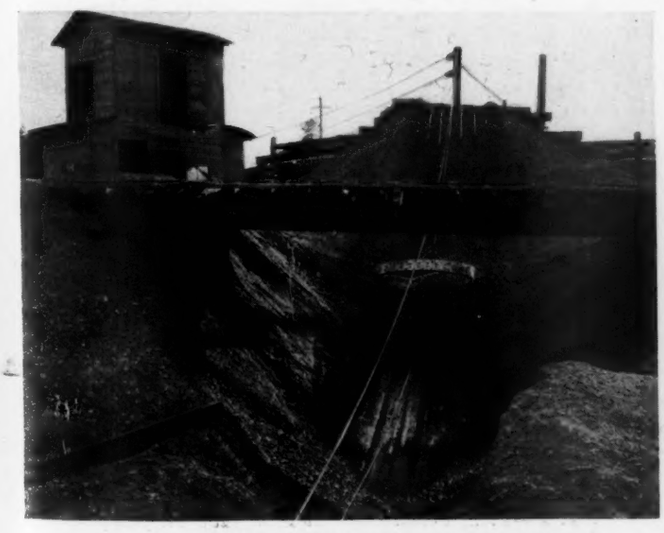
Although there are many alibis for the car getting loose there is no good reason for the car being allowed to hurl itself back into the quarry. A short piece of 4 x 4 with two short lengths of chain attached by suitable eye bolts may easily be fastened to the end of the car, and if the car does break loose this drag either will stop the car or derail it without excessive damage. The accompanying illustration of this simple device is taken from *National Safety News*.

Removing Water from Dredged Gravel

By R. A. Goodwin

AT FOREST HILL, La., Gifford-Hill and Co. has a gravel washing and screening plant fed by a belt conveyor inclined at a steep enough angle that the wet, coarse gravel tends to roll on the belt instead of riding it up the incline. It has smoothed out the difficulty by eliminating one of the sources of the trouble—the presence of superfluous water—by draining the material in a sump and feeding from this sump to the belt conveyor with a 2-cu. yd. drag scraper. This scraper installation is also of special interest because of its uncommonly short span—only about 60 ft.

Sand and gravel is dredged from the pit by two 10-in. pumps and is discharged on to gravity screens at a simple carloading plant. These screens take out part of the sand, which then passes through sand settlers and thence direct to cars for commercial sand, and leave the remainder of the material with about 80% gravel and 20% sand. The pumps can produce about 75 cars of this material a day, and some 24 cars daily are shipped out as a good quality semi-washed railroad ballast; the remainder is hauled in center-dump ballast cars to the washing and screening plant, about a third of a mile away, and prepared for sale as concrete gravel. Since the material in the cars still contains quite a bit of water when it reaches the plant, it is too wet to be dumped directly to the inclined conveyor; accordingly, the cars discharge from a trestle to a sump of about one car capacity, where the gravel has a chance to drain. Then the drag scraper, a 2-cu. yd. Sauerman machine, drags it out of this sump up an incline to a hopper feeding the belt conveyor. On its short haul the scraper has a capacity of 150 to 200 cu. yd. hourly, depending on the percentage of sand in the material and the length of time required to clean it from the cars. Sand that goes through the washing plant is wasted; hence cars picked out for the plant are, whenever possible, those with as little sand as possible. Sometimes, however, a car will be too sandy to be sent out for railroad ballast and will have to be dumped into the sump for the washing plant.

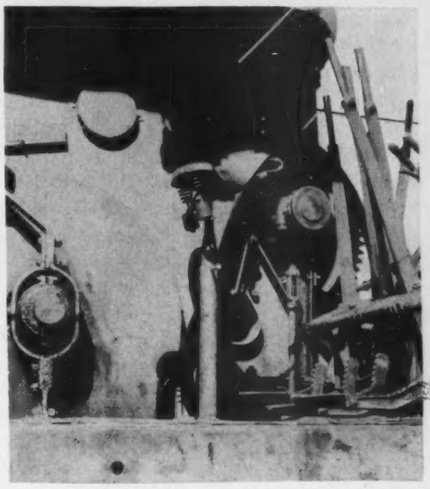


Drag scraper recovers aggregate after draining

Seat for Shovel Operator

By H. L. Kauffman
Denver, Colo.

AN EXCELLENT SEAT for the steam shovel engineer is made by attaching the seat of a bicycle or motorcycle to the



Height of seat is adjustable

end of a section of pipe, which in turn fits inside another larger pipe, bolted or welded to the floor of the cab. By drilling several holes through both pipes, and inserting a cotter pin, the height of the seat may be regulated to suit the operator.

Solving Rough Haulage Problem

HAULING in quarries with rough floors has been a troublesome problem to many operators. This has been solved in the work illustrated by using the "Camel," a tractor dump wagon. With crawler drive, flexible front axle and steel wheels, this unit has demonstrated its ability to handle large tonnages of rock under difficult operating conditions, as shown in the illustration below.

Flexible front axle and steel tires for rough haulage

Rock Products Clinic

On Washing Crushed Stone

THE EDITOR: We often strive unnecessarily hard to attain an object that in itself is simple. This may be due to our following the other fellow instead of being original.

This remark was suggested to me when reading the article in the October 24 issue of Rock Products, entitled "Principle of Washing as Applied to Crushed Stone." I cannot look with favor on some of the older methods used and as discussed in part of the article. The amount of good timber used in building the large phosphate washing plants in Florida and other parts of the country seems unnecessarily great for the actual results secured. (Note Fig. 1, photograph of a specimen plant.) This timber is used to support a heterogeneous conglomeration of washing machinery in the form of launders, log washers, screens of all shapes and designs, as well as pumps using both muddy and clean water—all for what purpose? To remove adhering foreign matter from the parent mixture and partially disintegrate the colloidal clay slabs and balls, in order to clean the grains of phosphate; or stone or gravel, as the case may be. Hundreds of thousands of tons of clay balls have passed through the machinery and now lie upon the waste heaps because of their cohering tenacity resisting disintegration.

Several years ago, upon one of my unlimited vacations, I found myself in Florida's salubrious climate, and as a mining engineer I was attracted to the phosphate diggings where the old fashioned but still up-to-date hydraulic "giant" was used to remove both overburden and placer ground. For 50 years or more I have been interested in gold placer mining where natural hydrostatic pressure almost invariably was the power behind the gun, but in Florida they are compelled to use artificial power of different forms. The question to me was, why waste this power by pumping thousands of tons of rock and tens of thousands of tons of water to an elevation of 100 ft. or more when less than half the elevation would accomplish a better result? The answer was, adopt more of the machinery originally used in mining and metallurgical methods to obtain practically the same economic result and an increased financial benefit.

Upon returning to New York I suggested the possibility to one of my former mining clients who was largely interested in one of the mines. His remark was "go to it!" The next winter I again visited Florida with a practical though makeshift trial outfit. (See Fig. 2.) The superintendent on the ground was skeptical though helpful, but I was bucking prejudice, for the superintendent remarked: "I've been 21 years at this washing game and you've got to show me." Few men are willing to have their life experience scrapped, but this same superintendent is now and has been for the past two or three years one of the greatest honest boosters for a method of washng as unique as it is simple, based upon the principle first shown to us by old man "Glacier," who has employed thousands of years and thousands of miles of travel in removing the coatings on rocks. But old man "Glacier" used superincumbent pressure to produce results. Little was accomplished by the rain spraying upon the rocks and debris resting upon his surface. Results were accomplished when he turned over his burden and subjected it to superincumbent pressure beneath the surface.

This young-old world was performing another act in raising the land below the ocean bed in the southern part of the United States, entrapping its multitude of sea life and converting it to B. P. L. (Bone Phosphate of Lime) with its included colloidal clays. How shall we separate these foreign materials? The answer is simple: Use a little mechanical common sense and employ old man "Glacier" as our consulting engineer, or at least follow his methods. He always worked upon the lines of simplicity. It has been said "there is nothing new under the sun," but this is a case of the Sun getting the best of the Old Man by disintegrating his disintegrator. The idea has been improved upon and is incorporated in the conical scrubber.

H. W. Hardinge,
Consulting engineer—Retired.

Aging Lime Putty

THE EDITOR: I note in the issue of Rock Products, November 7, under your *Rock Products Clinic*, certain recommendations concerning the aging of lime putty. This particular problem I have met for many years, and after trying out bottom drainage vats, wooden vats, and concrete vats of various construction I have found that a close control at the slaker of the water necessary to properly combine with a particular proportion of lime is a very simple and most satisfactory solution.

An accurate control in gallons of water per ton of lime permits me to slake down today and produce any desired consistency of lime putty at seven to ten days hence. In eight years we have never had any pitting whatsoever and entertain no difficulties in this respect, barring minor adjustments due to the variations in the hardness of burning and the chemical composition of the lime.

I have obtained equally satisfactory results with batch slakers and continuous slakers.

A. E. Tuttle,
Blue Diamond Co., Malden, Mass.

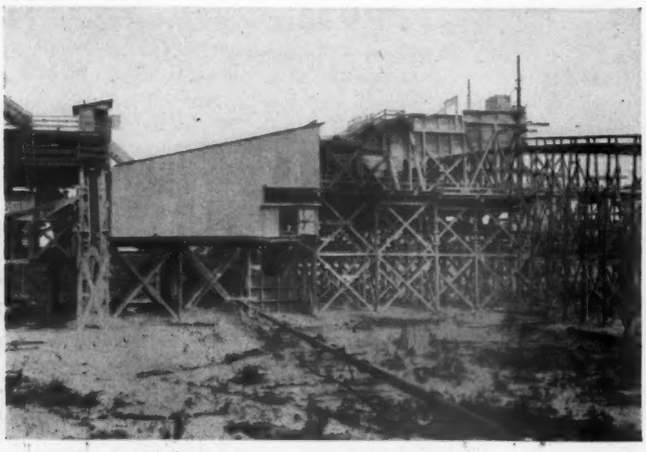


Fig. 1—Plant with considerable timber supporting machinery

Fig. 2—Trial washer installed to save on pumping power

Editorial Comment

The Annual Conventions

To us the most interesting thing about the Pittsburgh conventions, reported in this issue, was the obvious intense interest in all phases of the economics of the industry, and of industry and society in general. Certainly none could have attended the conventions and come away without being firmly convinced of the interdependence of one industry upon another, of industry upon government, of government upon industry. So, having enlarged his vision and broadened his mind, the home-coming producer should be in a proper frame of mind to recognize the dependence of his own success on the success of his neighboring producers, and hence, it is to be hoped in a frame of mind "to live and let live." His chief problem will be to communicate his enlightened point of view to his stay-at-home neighbor. But where there's a will there's a way.

Progress and Stabilization

One of the chief executives of a great life insurance company is said to have lectured his star salesmen recently on how to get business; and among other things he said he hated all this talk and comment on "stabilization," because to him stabilization meant too much of *stagnation*. When referring to an individual business organization this executive undoubtedly voiced the opinion or idea of practically every red-blooded American business man. We can not conceive of any business standing still. We are continually gambling on its going ahead.

But when we consider industry as a whole, or any one branch of industry as a whole, it seems that stabilization is a thing very much to be desired. How much progress can be made in stabilizing business and industry in general so long as the idea persists that an individual business can not be stabilized remains to be seen. It seems to us that the time is coming when a way must be found to stabilize an individual business without fatal consequences to that business.

We have become accustomed to expect bigger and better business in *all* lines as a matter of course, save for occasional set-backs, as a result of a continuous increase in population, a continuous increase in national wealth, etc., etc.

Now, it is an indisputable fact that the *rate* of population increase is decreasing. For the first time in history the flow of immigration to this country was reversed, during the year ended June 30, 1931. Some 10,000 more persons left this country, presumably for good, than entered with the intention of becoming citizens. And the birth rate is decreasing.

It would seem obvious then that such business and industry as depends wholly on population must adjust itself to a slower *rate* of growth than it has enjoyed in times past.

How far reaching the effect of this may be on general business and economic conditions, is too much for any one to hazard a guess. But business men and leaders of industry must face facts as well as develop theories. If their business is to enjoy their desired expansion, it must be, frankly, at the expense of some other business or industry. How personally selfish it is good business policy or good patriotism to be is the real issue that is to be determined.

Opportunities Exist for Real Leaders

The greatest problem of business today is management. For to management must be credited (or debited) the position of every business within its industry. Successful management means strong leadership. Such leadership does not wait for opportunities. It does not say "this situation must pass before we can make progress." It doesn't always follow the crowd and do all those things others are doing. *Instead*—successful leadership seeks opportunity. It says, "there is a way to do business *at a profit*." It analyzes and studies fully present conditions and future trends. It carefully determines its economic basis for existence. It creates a thoroughly sound plan for its operation based on this knowledge and puts it into effect.

This is true leadership. It can be as effective in the rock products industry as in the radio business. In the radio industry, amidst widespread dumping, ridiculously low prices and a general state of unprofitable operation, the Philadelphia Battery Co. has risen from twenty-fifth place in the industry in 1928 to first in 1931. During 1931 its business has been virtually 100% ahead of 1930 (a record year with it) in dollar volume and it is selling three times as many radios. This has been accomplished through planning based on a full knowledge of the market and a carefully executed sales program.

Various instances might be cited of organizations that have been successful in increasing 1931 profits over those of 1930. Unfortunately they are in the minority. But sufficient instances in a diversity of industries demonstrate the possibilities to those who may be skeptical of the opportunities.

True, opportunities may not be so plentiful, so easily corralled as in times past. They cannot be won by waiting or hoping. Half-hearted attempts will not bring home the bacon. But for those with the will, the drive and a thorough knowledge of the task to be done, will find ways and means to create opportunities.

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

Stock	Date	Bid	Asked	Dividend
Allentown P. C. 1st 6's[25]	1-26-32	85	95	
Alpha P. C. new com.[2]	1-23-32	8¼	9¾	25c qu. Jan. 25
Alpha P. C. pfd.[2]	1-23-32	85	100	1.75 qu. Dec.15,'31
Amalgamated Phosphate Co. 6's, 1936[19]	12-31-31	90	95	
American Aggregates com.[27]	1-26-32	2	5	
American Aggregates pfd.[19]	12-31-31	5	20	1.75 qu. Jan. 1
Amer. Aggr. 6's, w.w.[19]	12-31-31	40	50	
Amer. Aggr. 6's, ex-w.[19]	12-31-31	38	48	
Amer. L. & S. 1st 7's[27]	1-26-32	71	75	
American Silica Corp. 6½'s[39]	1-26-32	No market		
Arundel Corp. new com.	1-25-32	26 actual sale		75c qu. Jan. 2
Bessemer L. & C. Class A[4]	1-21-32	.....	7½	
Bessemer L. & C. 1st 6½'s[4]	1-21-32	.....	35	
Bloomington Limestone 6's[27]	1-26-32	.....	28	
Boston S. & G. new com.[37]	1-21-32	4½	7	15c qu. Jan. 2
Boston S. & G. new 7% pfd.[37]	1-21-32	30	35	87½c qu. Jan. 2
California Art Tile, A	1-21-32	1.1	5¼	
California Art Tile, B[40]	1-21-32	.....	2	
Calaveras Cement com.	1-21-32	1½	4	
Calaveras Cement 7% pfd.	1-21-32	.....	65	1.75 qu. Jan. 15
Canada Cement com.	1-25-32	6	6½	
Canada Cement pfd.	1-25-32	62	63¾	1.62½ qu. Dec. 31, 1931
Canada Cement 5½'s	1-19-32	87	90	
Canada Crushed Stone bonds[42]	12-30-31	70	80	
Canada Crushed Stone com.[42]	12-30-31	No market		
Certainteed Products com.	1-25-32	2⅝	3	
Certainteed Products pfd.	1-25-32	11⅞	19½	1.75 qu. Jan. 1
Cleveland Quarries	1-25-32	.....	50	25c qu. Dec.1,'31
Columbia S. & G. pfd.	12-15-31	88	91	
Consol. Cement 1st 6½'s, A[44]	1-22-32	8	12	
Consol. Cement notes, 1941[27]	1-26-32	No market		
Consol. Cement pfd.[27]	1-26-32	.....	55	
Consolidated Oka Sand and Gravel (Canada) 6½'s[42]	1-22-32	90	95	
Consolidated Oka Sand and Gravel (Canada) pfd.[42]	1-19-32	50	.....	1.75 qu. Oct.10,'31
Consol. Rock Prod. com.[9]	1-22-32	25c	35c	
Consol. Rock Prod. pfd.[9]	1-22-32	2	2½	
Consol. Rock Prod. units[25]	1-21-32	2	3	
Consol. S & G. pfd. (Can.)	1-25-32	.....	55	1.75 qu. Nov.16,'31
Construction Mat. com.	1-25-32	75c	2	
Construction Mat. pfd.	1-25-32	5	7½	
Consumers Rock and Gravel, 1st Mtg. 6's, 1948[35]	1-21-32	50	60	
Coosa P. C. 1st 6's[23]	1-21-32	27	40	
Coplay Cem. Mfg. 1st 6's[33]	1-21-32	60	.....	
Coplay Cem. Mfg. com.[33]	12-30-31	5	7½	
Coplay Cem. Mfg. pfd.[33]	12-30-31	25	40	
Dolese and Shepard	1-25-32	18	21	$1 qu. Jan. 1
Dufferin Pav. & Cr. Stone pfd.	1-25-32	.....	53	1.75 qu. Jan. 2
Dufferin Pav. & Cr. Stone com.	1-25-32	3	5	
Edison P. C. com.[32]	1-21-32	1½	.....	
Edison P. C. pfd.[32]	1-21-32	5	.....	
Federal P. C. 6½'s, 1941[19]	12-31-31	72	76	
Giant P. C. com.[2]	1-23-32	2½	4½	
Giant P. C. pfd.[2]	1-23-32	8	12	1.75 s.-a. Dec. 15, 1931
Gyp. Lime & Alabastine, Ltd.	1-18-32	5 actual sale		10c qu. Oct.5,'31
Gyp. Lime & Alabastine 5½'s	1-19-32	65	70	
Hermitage Cement com.[11]	1-23-32	5	10	
Hermitage Cement pfd.[11]	1-23-32	35	45	
Ideal Cement, new com.	1-25-32	19	22	50c qu. Jan. 2 & 25c ex.Dec.22,'31
Ideal Cement 5's, 1943	1- 6-32	95	98	
Indiana Limestone units[27]	1-26-32	No market		
Indiana Limestone 6's	1-22-32	17½	19	
International Cem. com.	1-25-32	17	18	75c qu. Dec.31,'31
International Cem. bonds, 5's	1-23-32	68½	70¼	Semi-ann. int.
Iron City Sand & Gravel 6's, 1940[36]	1-21-32	.....	70	
Kelley Is. L. & T. new stock	1-25-32	15	16⅞	25c qu. Jan. 1
Ky. Cons. Stone com.	1-25-32	.....	2	
Ky. Cons. Stone pfd.	1-25-32	.....	50	1.75 qu.
Ky. Cons. St. 1st Mtg. 6½'s[45]	12-30-31	30	40	
Ky. Cons. St. V. T. C.[45]	12-30-31	1	3	
Ky. Rock Asphalt com.	1-25-32	3½	4¼	
Ky. Rock Asphalt pfd.	1-25-32	33	36	1.75 qu. Dec.1,'31
Ky. Rock Asphalt 6½'s	1-23-32	80	85	
Ky. Rock Asphalt warrants[45]	1-25-32	1	2	
Lawrence P. C.	1-23-32	11	16	
Lawrence P. C. 5½'s, 1942[2]	1-23-32	42	45	
Lehigh P. C. com.	1-25-32	6	8	
Lehigh P. C. pfd.	1-25-32	75	80½	1.75 qu. Jan. 2
Louisville Cement[45]	1-25-32	175	225	
Lyman-Richey 1st 6's, 1932[13]	1-24-32	95	.....	
Lyman-Richey 1st 6's, 1935[13]	1-24-32	90	.....	
MarbleheadLime 6's[14]	1-21-32	75	80	
Marbelite Corp. com.[35] (cement products)	1-21-32	.....	75c	
Marbelite Corp. pfd.[35]	1-21-32	1	.....	
Marquette Cem. Mfg. 1st 5's, 1936[16]	1-26-32	80	.....	
Marquette Cem. Mfg. 1st 6's, 1936[16]	1-26-32	90	92	
Material Service Corp.	1-25-32	13½	14½	
McCrady-Rodgers 7% pfd.[22]	1-20-32	36	40	87½c qu. Dec. 30,
McCrady-Rodgers com.[22]	1-20-32	10	15	75c qu. Jan. 26
Medusa Portland Cement	1-25-32	12	15	
Michigan L. & C. com.[6]	1-23-32	45	.....	
Missouri P. C.	1-25-32	14	16	25c qu. Jan. 30
Monolith Portland Midwest com.[9]	1-22-32	75c	1	
Monolith P. C. com.[9]	1-22-32	1½	2	40c s.-a. Jan. 1
Monolith P. C. pfd.[9]	1-22-32	3½	4	40c s.-a. Jan. 1
Monolith P. C. units[9]	1-22-32	8½	10	
Monolith P. C. 1st Mtg. 6's[9]	1-22-32	65	70	
National Cem. (Can.) 1st 7's[27]	1-26-32	90	95	
National Gypsum A com.[27]	1-26-32	2	2½	
National Gypsum pfd.[27]	1-26-32	30	37	1.75 qu. Jan. 2
National Gypsum 6's[3]	1-27-32	50	.....	
Nazareth Cement com.[25]	12-12-31	3	.....	
Nazareth Cement pfd.[25]	12-12-31	60	.....	
Newaygo P. C. 1st 6½'s[27]	1-26-32	75	.....	
New England Lime 6's, 1935[14]	1-21-32	50	75	
N. Y. Trap Rock 1st 6's	1-25-32	67 actual sale		
N. Y. Trap Rock 7% pfd.[26]	12-31-31	.....	55	1.75 qu. Jan. 2
North Amer. Cem. 1st 6½'s	1-25-32	20½ actual sale		
North Amer. Cem. com.[27]	1-26-32	50c	1	
North Amer. Cem. 7% pfd.[27]	1-26-32	3	5	
North Shore Mat. 1st 5's[15]	1-26-32	No market		
Northwestern States P. C.[31]	1- 4-32	.....	75	
Ohio River S. & G. com.	1-25-32	.....	8	
Ohio River S. & G. 7% pfd.	1-25-32	.....	98	
Ohio River S. & G. 6's[16]	1-21-32	.....	80	
Oregon P. C. com.[9]	1-22-32	8	12	
Oregon P. C. pfd.[9]	1-22-32	80	85	
Pacific Coast Aggr. com.[40]	1-21-32	.....	25c	
Pacific Coast Aggr. pfd.[40]	1-21-32	10c	30c	
Pacific P. C. com.	1-21-32	.....	8	
Pacific P. C. pfd.	1-21-32	.....	50	1.62½ qu. Jan. 5
Pacific P. C. 6's	1-21-32	.....	94	
Peerless Cement com.[1]	1-21-32	25c	75c	
Peerless Cement pfd.[1]	1-21-32	10	20	
Penn.-Dixie Cement com.	1-25-32	1	1⅛	
Penn.-Dixie Cement pfd.	1-25-32	4¼	5	
Penn.-Dixie Cement 6's	1-23-32	42¼ actual sale		
Penn. Glass Sand Corp. pfd.	1- 6-32	75	85	
Penn. Glass Sand Corp. 6's	1- 6-32	86	90	
Petoskey P. C.	1-25-32	2¼	3¼	
Port Stockton Cem. com.[9]	1-22-32	No market		
Riverside Cement com.[9]	1-22-32	.....	12	
Riverside Cement pfd.[9]	1-22-32	55	60	1.50 qu. Feb. 1
Riverside Cement, A[9]	1-15-32	6	8	
Riverside Cement, B[9]	1-22-32	70c	1	
Roquemore Gravel 6½'s,[17]	1-21-32	98	100	
Sandusky Cement 6½'s, 1931-37[19]	12-31-31	90	100	
Santa Cruz P. C. com.	1-21-32	.....	75	$1 qu. Jan. 1 & $2 ex. Dec.24,'31
Schumacher Wallboard com.	1-21-32	1	.....	
Schumacher Wallboard pfd.	1-21-32	.....	12	50c qu. Nov.15,'31
Southwestern P. C. units[35]	1-21-32	175	225	
Standard Paving & Mat. (Canada) com.	1-25-32	3	5	
Standard Paving & Mat. pfd.	1-25-32	.....	58	1.75 qu. Nov.16,'31
Superior P. C., A	1-21-32	27½	32	27½c mo. Feb. 1
Superior P. C., B	1-21-32	5¼	8	25c Dec. 21, '31
Trinity P. C. units[31]	1- 4-32	80	.....	
Trinity P. C. com.[31]	1- 4-32	12	.....	
U. S. Gypsum com.	1-25-32	21	22	40c qu. Dec.31,'31
U. S. Gypsum pfd.	1-25-32	109½	116¼	1.75 qu. Dec.31,'31
Wabash P. C.[21]	1-26-32	.....	15	
Warner Co. com.[16]	1-21-32	4½	5	25c qu. Oct.15,'31
Warner Co. 1st 7% pfd.[16]	1-21-32	.....	75	1.75 qu. Jan. 1
Warner Co. 6's, '41	1-23-32	46	49	
Warner Co. 1st 6's 1944 w.w.	1-23-32	66 actual sale		
Whitehall Cem. Mfg. com.[30]	1-25-32	.....	90	
Whitehall Cem. Mfg. pfd.[30]	1-25-32	.....	50	
Wisconsin L. & C. 1st 6's[15]	1-26-32	No market		
Wolverine P. C. com.	1-25-32	.....	3¼	15c qu. Nov.15,'31
Yosemite P. C. A com.[9]	1-22-32	1	1½	

Quotations by: [1]Watling Lerchen & Hayes Co., Detroit, Mich. [2]Bristol & Willett, New York. [3]Rogers, Tracy Co., Chicago. [4]Butler, Beadling & Co., Youngstown, Ohio. [5]Smith, Camp & Riley, San Francisco, Calif. [6]Frederick H. Hatch & Co., New York. [7]J. J. B. Hilliard & Son, Louisville, Ky. [8]Dillon, Read & Co., Chicago, Ill. [9]A. E. White Co., San Francisco, Calif. [10]Lee Higginson & Co., Boston and Chicago. [11]J. W. Jakes & Co., Nashville, Tenn. [12]James Richardson & Sons, Ltd., Winnipeg, Man. [13]Stern Bros. & Co., Kansas City, Mo. [14]First Wisconsin Co., Milwaukee, Wis. [15]Central-Republic Bank & Trust Co., Chicago. [16]J. S. Wilson, Jr., Baltimore, Md. [17]Citizens Southern Co., Savannah, Ga. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hewitt, Ladin & Co., New York. [20]Tucker, Hunter, Dulin & Co., San Francisco, Calif. [21]Baker, Simonds & Co., Inc., Detroit, Mich. [22]Peoples-Pittsburgh Trust Co., Pittsburgh, Penn. [23]Howard R. Taylor & Co., Baltimore. [24]Richards & Co., Philadelphia, Penn. [25]Hincks Bros. & Co., Bridgeport, Conn. [26]Bank of Republic, Chicago, Ill. [27]National City Co., Chicago, Ill. [28]Chicago Trust Co., Chicago, Ill. [29]Boettcher-Newton & Co., Denver. [30]Hanson and Hanson, New York. [31]S. F. Holzinger & Co., Milwaukee, Wis. [32]Tobey and Kirk, New York. [33]Steiner, Rouse and Co., New York. [34]Jones, Heward & Co., Montreal, Que. [35]Tenney, Williams & Co., Los Angeles, Calif. [36]Stein Bros. & Boyce, Baltimore, Md. [37]Wise, Hobbs & Arnold, Boston. [38]E. W. Hays & Co., Louisville, Ky. [39]Blythe Witter & Co., Chicago, Ill. [40]Martin Judge Co., San Francisco, Calif. [41]A. J. Pattison Jr. & Co. Ltd., Toronto, Canada. [42]Nesbitt, Thomson & Co., Toronto. [44]E. H. Rollins, Chicago. [45]Dunlap, Wakefield & Co., Louisville, Ky. [46]First Union Trust & Savings Bank, Chicago.

Balance Sheet of Blue Diamond Corp., Ltd.

THE Blue Diamond Corp., Ltd., a consolidation organized in 1930 of the Blue Diamond Co., Los Angeles, Calif., and the Blue Diamond Co. of Nevada, owning gypsum plants, sand and gravel plants, cement clinker grinding mill and a building material supply business, reports a balance sheet as of October 31, 1931, as follows:

ASSETS	
Land, deposits, buildings, etc.	$2,779,292
Current assets:	
Cash and call loans	263,355
Notes and accounts receivable	226,319
Inventories	212,922
Prepaid expenses and other assets	73,806
Total	$3,555,694
LIABILITIES	
Capital stock	$2,639,375
Funded debt	686,000
Current liabilities:	
Accounts payable, etc.	155,879
Earned surplus	74,440
Total	$3,555,694
Current assets	$702,596
Current liabilities	155,879
Working capital	$546,717

Gypsum, Lime and Alabastine, Canada, Omits Dividend

CULMINATING a series of reductions in common stock dividends, announcement was made by Gypsum, Lime and Alabastine, Canada, that the disbursement usually payable on January 1 would be omitted. The last payment on the common was made on October 5 when a quarterly dividend of 10 c. a share was distributed.

Action of the directors in suspending disbursements on the common was not unforeseen. Some doubt existed whether the October payment would be made; as it was, the disbursement represented a 50% cut from the previous one.

Sales have fallen away considerably this year as a reflection of the decline in constructional activity, while export shipments have recently been hampered badly by the exchange situation. In September it was reported that sales were down by about 18%; it is likely that this figure may show a greater drop by the end of the year.—*Financial Post* (Toronto, Ont.).

National Cement Co. (Canada) to Distribute Assets

THE directors of the National Cement Co. (Montreal, Que.) have adopted a by-law providing for the distribution of the capital assets of the company. It will be recalled that a notice was sent out recently to bondholders calling a meeting to discuss and approve of this move.

National Cement Co. came into being about seven years ago, when a plant was established in Montreal East for the manufacture of portland cement. In 1925 control was acquired by Alf. Rogers of Toronto, who in turn sold out to Canada Cement Co.

Recent Dividends Announced

American Aggregates pfd. (qu.)	$1.75,	Jan. 1
Arundel Corp. com. (qu.)	0.75,	Jan. 2
Boston Sand and Gravel com. (qu.)	0.15,	Jan. 2
Boston Sand and Gravel pfd. (qu.)	0.87½,	Jan. 2
Calaveras Cement pfd. (qu.)	1.75,	Jan. 15
Dufferin Paving and Crushed Stone 1st pfd. (qu.)	1.75,	Jan. 2
Kelley Island L. & T. com. (qu.)	0.25,	Jan. 1
Liberty Limestone 7% pfd. (qu.)	1.75,	Jan. 1
Limestone Products 7% pfd. (qu.)	0.62½,	Apr. 1
Marquette Cement Mfg. pfd. (qu.)	1.25,	Jan. 2
McCrady-Rodgers pfd. (qu.)	0.87½,	Dec. 30
Medusa Portland Cement pfd. (qu.)	1.50,	Jan. 1
Missouri Portland Cement (qu.)	0.25,	Jan. 30
Newaygo Portland Cement 7% pfd. (qu.)	1.75,	Jan. 1
New York Trap Rock pfd. (qu.)	1.75,	Jan. 2
Northwestern Portland Cement pfd.	2.00,	Jan. 1
Pacific Portland Cement pfd. (qu.)	1.62½,	Jan. 5
Riverside Cement pfd. (qu.)	1.50,	Feb. 1
Santa Cruz Portland Cement com. (qu.)	1.00,	Jan. 1
Santa Cruz Portland Cement com. (extra)	2.00,	Dec. 24
Superior Portland Cement Cl. A (mo.)	0.27½,	Feb. 1

Financial Readjustment of the Pacific Coast Aggregates, Inc.

THE Pacific Coast Aggegates, Inc., San Francisco, Calif., which started operations in the sand and gravel business in central California in 1929 following consolidation of independent properties, has not sufficient working capital with which to continue operations and to pay in full the semi-annual interest and sinking fund requirements on funded debt.

Interest and sinking fund requirements were due January 1, 1932, on $3,927,000 of 6½% first mortgage bonds and $1,389,000 of 7% debentures now outstanding.

Total interest and sinking fund payments due January 1 aggregate $185,634. This is classified as follows: $127,627 as interest on the bonds, $35,720 for sinking fund on the bonds, $13,615 interest on the debentures and $8672 for sinking fund payments on the debentures.

The company is advising bond and debenture holders of a readjustment plan that proposes that interest and sinking fund payments on the bonds for the calendar years 1932, 1933 and 1934 be so modified as to be payable solely from net income of the company. Similarly, it is proposed that interest and sinking fund requirements on the debentures for the same period be payable solely from available net income of the company after application of such income to the payment of all interest and sinking fund requirements on the first mortgage bonds.

The resulting relief, it is expected, will enable the company to pay one-half of the interest due January 1, 1932, on the bonds in cash, and to make further payments during the three-year period out of available net income.

During the period of readjustment, from January 1, 1932, to and including July 1, 1934, all available net income of the company (subject to the maintenance of net current assets of $200,000, of which amount one-half shall be in cash) will be applied: First, to the payment of first mortgage bond interest (both current and accrued, together with interest on the unpaid matured interest coupons); second, to the payment of first mortgage sinking fund requirements (both current and accrued); and, third, the balance only will be available for interest and sinking fund payments on the debentures. The company will agree that until all interest and sinking fund payments and arrearages are paid on the first mortgage bonds and debentures, no dividends shall be declared or paid on the preferred or common stock of the company.

The announcement states: "The inability of the company to earn its fixed charges has been due primarily to the abnormal business conditions prevailing during 1931 and the latter part of 1930. The plants of the company are now operating at approximately two-thirds of the 1930 production, which, due to conditions prevailing in that year, was only approximately two-thirds of the rate of operation of the plants prior to their acquisition by the company."—*Pacific Coast Edition of the Wall Street Journal* (San Francisco, Calif.).

State-Owned Cement Plant Feels Effects of Competition

THE FOLLOWING ITEM appeared in the *Sioux City* (Ia.) *Journal* under the headline, "Cement Plant Profit Large." The article reads:

"South Dakota's cement plant at Rapid City made a net profit of $53,373 in 1931, its sales manager, E. E. Hartley, reported January 14 to Governor Green.

"For the first half of the year he reported net profit amounted to $54,510, but there was a net loss of $1137 in the second half, after deducting depreciation.

"Mr. Hartley's report said that because of a 'war' last year, prices were reduced approximately 35%."

Transfers Executive Offices to Chicago

THE BUSINESS of the Ruhm Phosphate and Chemical Co. will hereafter be conducted at the Chicago office at 2300 Willoughby Tower.

John Ruhm, Jr., president, will hereafter be located there instead of at Mt. Pleasant, Tenn.

Riverside Cement Co.'s Annual Report

THE Riverside Cement Co., Los Angeles, Calif., reports for the year ended December 31, 1931, net earnings of $401,373, after all charges, including federal income tax, equivalent to $7.03 a share on the 55,685 shares of $6 preferred stock outstanding. This compares with $509,279, or $8.61 a share on the 59,130 shares of preferred stock outstanding for the previous year.

The net earnings of $401,373 compare with dividend requirements on the preferred of $345,774 for 1931. During the year 1463 shares of preferred stock were retired and the company purchased and holds for future retirement an additional 3889 shares. The common stock is closely held.

Despite the fact that 1931 tonnage sales were considerably less than those of 1930, the provision for depreciation and depletion was kept in line with the established policy and amounted to $352,085. The reserve appropriations for this purpose in 1930 amounted to $372,120.

Through the adoption of rigid economies the company showed a smaller percentage of decline in net profits than in sales. Tonnage sales were only 64% of 1930 volume and net profits were 79% of the 1930 figure.

The balance sheet at the close of the year just passed showed a strong current position. The ratio of total current assets to total current liabilities was approximately 13 to 1, and cash alone amounted to five times total current liabilities. Indicated net working capital totaled $2,106,849.

In a letter which is being mailed to stockholders, John Treanor, president, commented in part as follows:

"One year ago your directors declined to venture any prediction concerning the probable course of operations during the year 1931. They deem it advisable to maintain this attitude with respect to 1932. Since the entire construction industry is so closely related to general business activity they feel that specific prophecy concerning the cement business should be deferred until general business recovery can be clearly foreseen. But it is permissible to point out the following facts:

"1. Tonnage sales in 1931 were 64% of 1930 tonnage.

"2. Net profits in 1931 were, however, 79% of 1930 net profits.

"3. Net profits in 1931, totaling $401,373, were obtained from the operation of less than one-third of the company's capacity.

"Your directors find satisfaction in this record. They believe that an organization which has successfully adapted itself to the severe conditions of the present depression may regard the future with confidence."

Although no comment was made relative to the amount of potential business that should arise out of construction scheduled for the next few years, the cement companies generally in southern California will benefit from supplying cement for the Hoover dam, Los Angeles aqueduct and the San Gabriel dam. The demand which will arise out of this construction work places the companies in this district in a unique position, in that their geographical location permits low freight costs which should place them at an advantage in securing the business and thereby maintaining operations at a fair rate, despite the general contraction in the construction industry.

Along with three other southern California companies, Riverside Cement Co. recently submitted a joint bid for 380,000 bbl. of cement to be used at the Hoover dam. The joint bid issued by these companies was the lowest bid received. There will be approximately 6,000,000 bbl. of cement used in this construction. The Los Angeles aqueduct will require a like amount.

While this demand will not materialize in full for a protracted period, the potential business from this source places these companies in a different position from cement companies operating in districts which do not have access to such an unusual demand. —*Pacific Coast Edition of the Wall Street Journal* (San Francisco).

THE COMPARATIVE BALANCE SHEET OF RIVERSIDE CEMENT CO., AS OF DECEMBER 31, 1931, 1930, 1929 AND 1928

ASSETS

	Dec. 31, '31	Dec. 31, '30	Dec. 31, '29	Dec. 31, '28
Cash	$947,442	$1,061,313	$1,622,701	$1,223,424
Notes and accounts receivable, less provision for discounts and bad debts	326,648	614,635	597,644	956,749
Inventories	1,012,509	896,167	901,639	1,036,532
Stocks and bonds	238,524	239,438	288,642	234,839
Treasury stock	260,042	157,374	109,659	.....
Other investments	560,128	310,785	308,952	727,355
Deferred charges	41,726	39,891	41,538	43,868
Real estate, plant and equipment, less depreciation and depletion	8,234,127	8,529,128	8,539,764	8,028,256
Total assets	$11,621,146	$11,848,731	$12,410,539	$12,251,023

LIABILITIES

Pay rolls, accruals and accounts payable	$143,723	$135,554	$260,414	$227,474
Reserve for federal income tax	36,027	94,165	158,786	233,373
Other reserves	150,331	239,273	348,418	262,781
Sundry items	60,313	40,244	35,942	55,119
Capital	9,552,500	9,552,500	9,552,500	9,500,000
Surplus	1,678,252	1,786,995	2,054,479	1,972,276
Total liabilities	$11,621,146	$11,848,731	$12,410,539	$12,251,023

Northwestern Portland Cement Co. Dividend on Preferred

STOCKHOLDERS of the Northwestern Portland Cement Co., at their annual meeting at Seattle, Wash., January 8, elected the following directors: James D. Burns of Condon, Ore.; C. T. W. Hollister of Seattle; W. J. Kerr of Corvallis, Ore.; Frank Kiernan of Portland; H. K. Metcalf of Eugene, Ore., and J. A. Reuter of The Dalles, Ore.

These directors thereupon met and elected C. T. W. Hollister, president; J. A. Reuter, first vice-president; Frank Kiernan, second vice-president; Carl W. Gath, secretary-treasurer, and H. K. Metcalf, assistant secretary.

The directors declared a dividend of $2 on the preferred stock. Financial reports showed current assets of $250,889 against current liabilities of $8713.

Annual Report of Northwestern States Portland Cement Co.

IN his annual report to stockholders of the Northwestern States Portland Cement Co., Mason City, Ia., Hanford MacNider, president, is quoted as follows:

"The company completed the last year with a most satisfactory record of sales and shipments. The price war within the industry, however, made it impossible to operate on the usual profitable basis. Drastic cuts in overhead, salaries and wages, together with every possible operating economy, have put the company on a basis of such efficiency and low cost that with any normal demand for the product in 1932 it will be able to make a satisfactory showing even under a continuation of the present conditions. The company has more orders upon its books today than is usual for the first of the year and is ready to take advantage of any improvement in the situation within our trade territory.

"The company is without indebtedness and in a particularly strong cash position. It can be safely assumed that the plants and properties are worth the present depreciated and depleted values at which they stand upon the books. The company's trade position has been maintained throughout the year without damage to the company's reputation for fair dealing and satisfactory service. With any return of normal conditions, it will be in a preferred position to show earnings of a worth-while character.

"The company's counsel is of the opinion that the plans for reorganization submitted to the stockholders last year should be ready for consummation within a few months."

NORTHWESTERN STATES PORTLAND CEMENT CO.

ASSETS

Plant and equipment (Mason City)	$6,545,994.24
Plant and equipment (Gilmore City)	565,711.67
Cement stock and materials in process	378,376.41
Inventories	245,175.80
Current assets	797,976.12
Investments and funds at interest	837,425.43
	$9,370,659.67

LIABILITIES

Capital stock	$5,250,000.00
Surplus (deficit)	9,014.05
Current liabilities	159,758.27
Reserves: (Depreciation, depletion, etc.)	3,969,915.45
	$9,370,659.67

Missouri Valley Aggregate Producers Meet

By Carl M. Hise

THIRTY-NINE sand and gravel producers from Kansas, Missouri and Oklahoma met and reorganized the Missouri Valley Sand and Gravel Association. The Missouri Valley Sand and Gravel Association is one of the oldest district associations in the sand and gravel industry, having been in operation some 12 years. In the last few years, however, this association has been more or less inactive, as its members were devoting most of their time to their state associations. Fully realizing that troubles and difficulties must be met within their own ranks, it was the opinion of all present that if a combined effort be used a better and quicker result could be accomplished. Hence, the combining of these state associations under the one head, namely, the Missouri Valley Sand and Gravel Association.

This association has elected the following officers for the year 1932: Otto Kuehne, Jr., chairman, Kansas Sand Co., Topeka; Frank W. Peck, vice-chairman, Peck-Thompson Sand and Material Co., Kansas City, Mo.; John Prince, treasurer, Stewart Sand and Material Co., Kansas City, Mo., and Carl M. Hise, executive secretary, Kansas City, Mo.

The Western Missouri Sand-Gravel Association, an association within the Missouri Valley Sand and Gravel Association, also held a meeting and elected the following officers for the year 1932: Frank W. Peck, president, Peck-Thompson Sand and Material Co., Kansas City, Mo.; R. J. Stewart, vice-president, Pioneer Sand Co., St. Joseph, Mo.; John Prince, treasurer, Stewart Sand and Material Co., Kansas City, Mo., and Carl M. Hise, executive secretary, Kansas City, Mo.

This association has at the present time 11 active members, all operating plants in the western part of Missouri.

The Sunflower Sand-Gravel Association, the Kansas branch of the Missouri Valley Sand and Gravel Association, held its first annual meeting and elected the following officers for 1932: Otto Kuehne, Jr., president, Kansas Sand Co., Topeka; E. B. Winkler, vice-president, Lawson Sand and Material Co., Kansas City, Mo.; T. P. Russell, treasurer, Southwest Sand and Gravel Co., Dodge City, and Carl M. Hise, executive secretary, Kansas City, Mo.

This association has a membership at the present time of 22 active members, all operating plants in the state of Kansas. This state association has been very active all year, and several very instructive talks were made during these two days on the direct accomplishments that this association has made for the producers of Kansas, one of the most outstanding being the arrangement of a school for sand and gravel producers at the Kansas State College of Agriculture and Applied Science at Manhattan, January 11, 12 and 13, with the State Highway Department. The program outlined below was arranged by Professor Scholer, construction material engineer of the school, and H. Allen, material engineer of the Highway Department. It is needless to say that the results of such a program will be far reaching to the sand and gravel producers of Kansas, and to the State Highway Department, as well as the public at large.

Papers read at the meeting were: Standard Physical Properties, by W. E. Gibson; Preliminary Tests in Design of Concrete Mix, by L. H. Koenitzer; Geology of the Material, by Professor Sperry; Design of Concrete by Trial Mix, by H. Allen, State Highway Department; Economy of Design for Surfacing Material, by L. H. Koenitzer; Sand-Gravel Surfacing, by I. E. Taylor, State Highway Department; Bituminous Mat Surfaces, by F. S. Gilmore, and Sand-Gravel in Bituminous Mats, by L. L. Marsh. A discussion followed most of the papers read. An interesting address was made by Stanton Walker, chief engineer, National Sand and Gravel Association, on Wednesday evening.

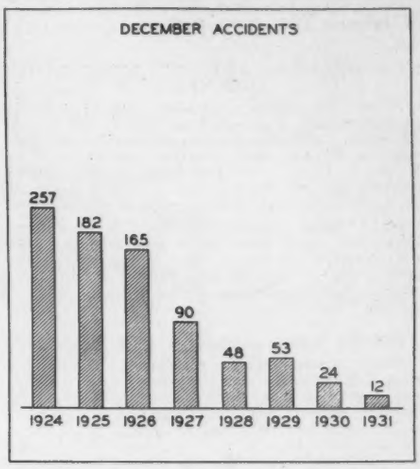
The following producers attended this joint meeting:

O. W. Knight, River Sand Co., Topeka, Kan.
Alva Stryker, Blue River Sand and Gravel Co., Irving, Kan.
Harry Moore, Missouri River Sand and Gravel Co., Booneville, Mo.
John Prince, Stewart Sand and Material Co., Kansas City, Mo.
Geo. Cook, Stewart Sand and Material Co., Kansas City, Mo.
Geo. Garrett, Stewart Sand and Material Co., Kansas City, Mo.
Wm. Stewart, Stewart Sand and Material Co., Kansas City, Mo.
M. M. Small, Victory Sand and Gravel Co., Topeka, Kan.
Otto Kuehne, Jr., Kansas Sand Co., Topeka, Kan.
A. F. Pierce, Kansas Sand Co., Topeka, Kan.
N. C. Dunn, Arkansas City Sand and Gravel Co., Arkansas City, Kan.
Roy More, More Sand Co., Junction City, Kan.
Walter Kennedy, Welch-Sandler Sand Co., Frisbie, Kan.
Harry Sandler, Welch-Sandler Sand Co., Kansas City, Mo.
Casimer J. Welch, Welch-Sandler Sand Co., Kansas City, Mo.
L. M. Chambers, DeSoto Kaw River Sand and Gravel Co., DeSoto, Kan.
R. Tuttle, DeSoto Kaw River Sand and Gravel Co., DeSoto, Kan.
Bert Fisher, Glasgow Sand Co., Glasgow, Mo.
E. R. Putnam, Putnam Sand Co., Salina, Kan.
E. E. Gimmell, Putnam Sand Co., Salina, Kan.
Frank W. Peck, Peck-Thompson Sand and Material Co., Kansas City, Mo.
Frank C. Peck, Peck-Thompson Sand and Material Co., Kansas City, Mo.
Wm. Pirnie, Peck-Thompson Sand and Material Co., Kansas City, Mo.
R. J. Stewart, Pioneer Sand Co., St. Joseph, Mo.
E. B. Winkler, Lawson Sand and Material Co., Kansas City, Mo.
C. C. Shackelsworth, Lawson Sand and Material Co., Kansas City, Mo.
Frank A. Laughead, Consumers Sand Co., Topeka, Kan.
Chas. Hoag, Consumers Sand Co., Topeka, Kan.
F. H. Gades, Lawrence Sand and Gravel Co., Lawrence, Kan.
E. C. Dresser, Dresser Sand Co., Leavenworth, Kan.
John Westover, Washington County Sand and Gravel Co., Hanover, Kan.
C. J. Jackson, Edwin Ahlskog, Holliday, Kan.
Frank Kaul, Blue Rapids Sand and Gravel Co., Blue Rapids, Kan.
Harry West, West Sand Co., Muskogee, Okla.
W. E. Seright, Independent Sand and Gravel Co., Wichita, Kan.
F. P. Morton, Webb City-Joplin Sand and Gravel Co., Mulvane, Kan.
W. E. Rogers, Arkansas River Sand Co., Tulsa, Okla.
Carl M. Hise, Kansas City, Mo.

December Accidents

THERE were 11 lost-time accidents and one fatal accident in the member plants of the Portland Cement Association during December. These compare favorably with the 24 accidents which occurred in the same group of plants during December, 1930.

The fatal accident reported during December, 1931, occurred in a quarry where a secondary driller was drilling holes at the bottom of the working face. As he was occupied there several large rocks slid down the face, and while endeavoring to remove himself from the path of danger the victim slipped and fell backward. His head struck a rock on the quarry floor, causing a fracture of the skull from which death resulted on the following day.



Comparison of December accidents

One of the most severe injuries of the month occurred to a locomotive engineer, beneath his engine. The locomotive was standing on a grade with the brakes released but with the throttle opened slightly to hold it against the grade. The engine moved about 5 in., striking engineer's legs, resulting in a compound comminuted fracture of an ankle and bones of the arch, with extensive laceration, and a fracture of the other ankle. He probably will be laid up for a long period.

The year's accident record closed with many accidents fewer than recorded during any previous year. The gross total for the year (subject to minor corrections) was 225, as compared with 419 accidents of lost time or more serious consequences which occurred during 1930, and 686 in 1929.

Receives New Government Contract for Cement

AN AVERAGE of 6000 bbl. of cement daily for an indefinite period is the requirement of a new order just received from the U. S. War Department by the Marquette Cement Manufacturing Co., Chicago, Ill.—*Atlanta* (Ga.) *Georgian.*

Traffic and Transportation

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week of January 23:

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

24106. To cancel commodity rate of 4½c on **stone, crushed,** from Hudson Upper, N. Y., to Chatham, Claverack, Ghent, Mellenville and Pulvers, N. Y., as named in Item 1505 of B. & A. R. R. I. C. C. 9165 and apply in lieu thereof mileage rate of 90c per net ton, per B. & A. R. R. I. C. C. 9165. Reason—Cancel obsolete rate.

24122. **Sand, common** (See Note 2), from Conn. High Test Sand and Gravel and Hamden Sand and Gravel Co.'s pit at New Haven to Dextone Co.'s siding at New Haven. Present rate, 51c per net ton, minimum charge $6.75; proposed, $20 per car (See Note 4).

TRUNK LINE ASSOCIATION DOCKET

28316. **Sand, common, building** (not blast, engine, fire, foundry, glass, molding or silica sand) and **gravel,** carloads (See Note 2), from Boonville and Alder Creek, N. Y. (rates per net ton), to Prospect Junction, Trenton Chasm, Gravesville, Poland, Newport, N. Y., proposed 75c, present 65c; Middleville and County Home, N. Y., proposed 83c, present 65c; Kast Bridge and Herkimer N. Y., proposed 91c, present 75c. Reason—The purpose for which the present rates were established no longer exists. Rates prior to August 19, 1931, will apply.

28317. **Sand, common or building,** not blast, engine, fire, foundry, glass, molding or silica sand, carloads, and **gravel** (See Note 2), from Boonville and Alder Creek, N. Y., to Inghams and Dolgeville, N. Y., $1.20, and Salisbury Centre, N. Y., $1.30 per net ton. (Present rate, $1 per net ton.) Reason—The purpose for which the present rates were established no longer exists. Rates prior to August 19, 1931, will apply.

28325. **Glass sand,** carloads (See Note 2), to Olean, N. Y., from Hancock, Berkeley Springs, Great Cacapon, W. Va., $2.25, and from Gore and Triplett, Va., $2.45 per net ton. Reason—Proposed rates are comparable with rates from Mapleton District, Penn.

28331. To add to Reading company Tariff I.C.C. No. 899, applying on **limestone** (finely ground), carloads, minimum weight 50,000 lb., to points on the Long Island R. R., Exton, Penn., as a point of origin, taking the same rate and minimum carload weights as applicable from Mill Lane, Penn.

28334. **Limestone** (finely ground), carloads, minimum weight 50,000 lb., from Annville, Penn., to Pedricktown, N. J., 12½c per 100 lb. (Present rate, 17c per 100 lb., sixth class.) Reason—Proposed rate is comparable with rates to Newark, High Bridge and Asbury Park, N. J.

28339. **Sand,** other than blast, engine, foundry, molding, glass, silica, quartz or silex, carloads (See Note 2), from Northeast, Md., to Elkton, Md., 45c per net ton. (Present rate, 65c per net ton.) (See Note 4.)

28352. **Glass sand,** carloads (See Note 2), to Alloy, W. Va., from Berkeley Springs, Great Cacapon and Hancock, W. Va., $2.60, and from Gore and Triplett, Va., $2.70 per net ton. Reason—Proposed rate is comparable with rate from Hancock district to Cedar Grove, Charleston, Huntington, W. Va., etc.

28353. **Slag,** carloads (See Note 2), from Catasauqua, Penn., to points in Pennsylvania:

To	Prop.	To	Prop.
Cresco	110	Pocono Summit	120
Mountain Home	110	Tobyhanna	120
Mt. Pocono	120	Gouldsboro	120

(Rates in cents per 2000 lb.) (See Note 5.)

24202. **Stone, broken or crushed,** in bulk in gondola or other open top cars (See Note 2), from Rocky Hill and East Wallingford (Reeds Gap Quarry), Conn., to North Windham, Conn. (See Note 4).

Sup. 1 to 28353. **Slag,** carloads (See Note 2), from Bethlehem, Penn., to Cresco, Mountain Home, Penn., $1.10, and Mt. Pocono, Pocono Summit, Tobyhanna and Gouldsboro, Penn., $1.20 per net ton.

28418. **Gravel and sand** (other than blast, engine, fire, foundry, glass, molding or silica), carloads (See Note 2), from Portland, Penn., district. To points in Pennsylvania:

	Prop. rates		Prop. rates
Mauch Chunk	$1.10	Jeddo	1.20
Andreas	1.10	Freeland	1.20
Orwigsburg	1.20	Hazleton	1.20
Pottsville	1.20	Audenried	1.20
Lehighton	1.00	Mahanoy City	1.20
Weatherly	1.10	Shenandoah	1.20
Beaver Meadow	1.20	Mt. Carmel	1.30
Jeanesville	1.20		

Rates in cents per net ton. (See Note 5.)

28376. **Crushed stone,** carloads (See Note 2), from Binghamton, N. Y., to D. L. & W. R. R. stations, Cresco, Gouldsboro, Scranton, Berwick, Hallstead, Penn., Owego, Kanona, Cortland, Cincinnatus, Oswego, Richfield Springs, Utica, N. Y., and various. Rates ranging from 60c to $1.20 per net ton. Reason—Proposed rates are comparable with rates from Jamesville, N. Y.

Note 1—Minimum weight marked capacity of car.

Note 2—Minimum weight 90% of marked capacity of car.

Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

Note 4—Reason—To meet motor truck competition.

Note 5—Reason—Proposed rates are comparable with rates on like commodities for like distances, services and conditions.

28377. **Slag,** carload (See Note 2), from Palmerton, Penn., to D. L. & W. R. R. stations, Hoboken, Newark, Chatham, Rockaway, Andover, Oxford Furnace, N. J., Bath, West Nanticoke, Northumberland, Penn., Binghamton, Ithaca, Wayland, Depew, Chenango Bridge, Syracuse, Oswego, Cedarville, N. Y., and various. Rates ranging from $1 to $2.10 per net ton. Reason—Proposed rates are fairly comparable with rates from Hokendauqua, Penn.

Sup. 1 to 28304. **Crushed slag,** carloads (See Note 2), from Catasauqua, Penn., to Black Creek Junction and Hudsondale, Penn., 80c, and Gerhards, Stewarts, Switchback, Quakake, Delano, Park Place and Mahanoy City, Penn., 90c per net ton.

28389. **Gravel and sand.** N. O. I. B. N., in O. C., except blast, engine, foundry glass, molding, quartz, silex and silica, carloads (See Note 2), from Netcong, N. J., to Stroudsburg, Penn., $1.15 per net ton. (Present rate $1.40.) Reason—Proposed rate is comparable with rate from Kenville, N. J., to Stroudsburg, Penn.

28391. **Limestone, ground or pulverized, and limestone dust,** carloads, minimum weight 50,000 lb., from Jamesville, N. Y., to Carbondale, Mayfield, Jermyn and Jermyn Transfer, Penn., $1.80, and Archbald, Penn., $1.95 per net ton. (Present rates sixth class. (See Note 5.)

28459. **Sand and gravel,** other than blast, engine, foundry, glass, molding or silica, carloads (See Note 2), from Alfred, N. Y., to Bradford, Penn., 95c, and Little Valley, N. Y., $1 per net ton (See Note 5).

28462. **Limestone, unburned, ground,** carloads, minimum weight 50,000 lb., from Natural Bridge, N. Y., to Harrisburg, Centre Hall, Penn., and Trenton, N. J., 24c per 100 lb. Present rate, 6th class. (See Note 5.)

28463. **Sand,** other than blast, engine, foundry, glass, loam or molding, and **gravel,** when shipped in open top cars, carloads (See Note 2), from Point Marion, Penn., to Uniontown, Penn., 60c per net ton. Present rate, 70c. (See Note 4.)

28466. To cancel the commodity rates on **sand, common or building** (not blast, engine, fire, foundry, glass, molding or silica sand), carloads, and **gravel,** carloads (See Note 2), from South Bethlehem, N. Y., to Feura Bush, Selkirk, Catskill, Alsen, Schenectady and Copake Falls, N. Y. Sixth class rates to apply. Reason—Investigation develops no traffic has moved for some time nor are there prospects for future shipments, therefore rates are obsolete.

28488. To cancel commodity rates on **stone, broken; stone, crushed, and stone screenings,** carloads, from Long Island City, N. Y., to various local points on the Long Island Railroad. Classification basis to apply. Reason—Investigation develops no traffic has moved for some time nor are there prospects for future shipments, therefore rates are obsolete.

28490. **Stone, natural** (other than bituminous asphalt rock), **crushed,** carloads (See Note 2), from Marlboro, N. Y., to points on the West Shore Railroad, Erie R. R., N. Y. O. & W. Ry.: West Camp, Wallkill, Campbell Hall, Highland, Newburgh, Highland Falls, Firthcliffe, Burnside, Fair Oaks, Ellenville, Hurley, Port Jervis, Monticello, Liberty, Cook's Falls, New Windsor, Central Valley, Tuxedo, Greycourt and various. Rates ranging from 60c to $1.50 per net ton. (See Note 5,)

CENTRAL FREIGHT ASSOCIATION DOCKET

30007. To establish on **sand and gravel,** carloads, in open top equipment, carloads, from Dresden, O., to Zanesville, O., rate of 45c per net ton, to expire six months from effective date. Present —50c, per P. R. R. Tariff Ohio F-1445.

30011. To establish on **granulated roofing,** consisting of **brick, gravel, gravel slate, stone, crushed or ground,** from Crawfordsville, Ind., rate of 150c, to E. St. Louis, Madison, Vandalia, Ill., and 180c per net ton to Waukegan, Ill. Present rates, sixth class.

30016. To establish on **stone, crushed** (in bulk), **crushed stone screenings** (in bulk), **agricultural limestone** (not ground or pulverized, in bulk, in open top cars only), and **agricultural limestone screenings,** in carloads, from Bellevue, O., to N. N. C. stations in Ohio, viz., Simons, Williamsfield, 125c; Stanhope, 135c; Coalburg, Youngstown, Wick, 125c, via N. Y. C. R. R. district, and Lisbon, 135c per net ton via N. Y. C. R. R., Youngstown, O., Y. & S., Signal, O., and P. L. & W. Present, 370c to Simons, 140c to Williamsfield, Stanhope, Coalburg, Youngstown, Wick and Lisbon, 340c per net ton.

30097. To establish on **sand and gravel,** carloads, to Petersburg. Ind., from Vincennes, Ind., 80c., and Allison Branch, Ill., 25c per net ton. Present, 98c.

30098. To establish on **sand and gravel,** in open top cars, carloads, from Ft. Jefferson, O., to Celina, O., rate of 50c pet net ton. via C. N. R. R. direct, to expire November 1, 1932. Present 60c per C. N. Tariff 1906-B.

30111. To establish on **agricultural limestone,** in box cars, carloads, minimum weight 50,000 lb., from Carey and McVittys, O., to Earling, W. Va., rate of 347c per net ton, via C. C. C. & St. L. Ry., Columbus, O., C. & O. Ry. Present rate, 27c.

30043. To establish on **crushed stone,** in open top cars, carloads, from McVittys, O., to Glendale, O., rate of 100c per net ton, via C. C. C. & St. L. Ry., Dayton, O., thence B. & O. R. R. Present, 18c, classification basis.

30060. To establish on **crushed and ground limestone,** carloads, minimum weight 40,000 lb., from Genoa and Martin, O., to Mt. Clemens, Mich., rate of 10c. Present, 16c.

30069. To establish on **crushed stone,** carloads, from Melvin, O., to Little Hocking, Porterfield and Belpre, O., rate of 100c per net ton. Present rate, 130c.

30093. To establish on **crushed stone,** in open top cars, carloads (See Note 3), from McVittys, O., to Sandusky, O., rate of 7?c. per net ton. Present, 80c.

30094. To establish on **sand and gravel,** in open top cars, carloads, from Evansville, Ind., to Sandy Hook, Ind., rate of 65c per net ton, via C. C. C. & St. L. Ry. (E. I. & T. H. Ry. Div.), to expire November 1, 1932. Present, 80c.

30118. To amend Item 1655 of C. F. A. L. Tariff 130-T, wherein is published equivalent table of rates on **agricultural limestone or agricultural limestone screenings,** carloads, from points on the N. Y. C. & St. L. R. R. (N. K. P. Dist.) in Ohio to stations in Ohio, by providing that said rates will also appply on traffic when originating at McVittys, O. Present rates, sixth class.

30154. To establish on **stone dust,** carloads, in box cars (See Note 3), from Carey and McVittys, O., to Muncie, Ind. Rate of 170c per net ton. Present rate, 176c per net ton.

30157. To establish on **sand and gravel,** carloads, from Attica, Ind., to Foresman, Ind., rate of 80c per net ton. Route: Via Wabash Ry.-C. A. & S. R. R. Present rate, 95c.

30036. To establish on **gravel and sand**, other than blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica, in straight or mixed carloads, in open top equipment, from Ashtabula, O., to points in Ohio, Pennsylvania, West Virginia (representative points shown in Exhibit A), rates as shown in Exhibit A attached. Present, as shown in Exhibit A attached.

EXHIBIT A

To representative points	Miles	Prop.	Pres.
New Lyme, O.	20	60	80
Walford, Penn.	80	90	105
New Castle, Penn.	82	100	105
Sharpsville, Penn.	106	100	105
Volant, Penn.	96	100	105
Milburn, Penn.	99	100	105
Snodes, O.	72	95	110
Beaver Falls, Penn.	95	100	160
Ambridge, Penn.	108	110	160
Pittsburgh, Penn.	125	120	160
New Waterford, O.	101	110	120
Leetonia, O.	92	105	110
Canton, O.	96	105	120
Orrville, O.	119	115	.....
Beaver, Penn.	101	110	160
Wellsville, O.	122	115	125
Steubenville, O.	136	125	.....
Wheeling, W. Va.	160	130	.....
Benwood, W. Va.	164	130	.....
Powhatan, O.	178	145	.....
Homeworth, O.	84	100	125
Minerva, O.	92	105	.....
Dover, O.	119	115	.....
Roswell, O.	128	125	.....
Marietta, O.	222	155	.....
Grafton, Penn.	131	120	160
Bulger, Penn.	148	120	.....
Weirton Jct., W. Va.	144	120	.....
Weirton, W. Va.	146	120	.....
Warwood, W. Va.	164	130	.....
Cadiz, W. Va.	167	135	.....
Homestead, Penn.	133	120	160
Donora, Penn.	160	130	.....
Belle Vernon, Penn.	167	130	.....
Smock, Penn.	186	140	.....
Brownsville, Penn.	180	140	.....
Bessemer, Penn.	137	120	160
Essler, Penn.	151	130	.....
Forbes Road, Penn.	168	130	.....
Andrico, Penn.	171	130	.....
Seward, Penn.	195	140	.....
Mutual, Penn.	167	130	.....
Yukon, Penn.	164	130	.....
Morewood, Penn.	179	140	.....
Monarch, Penn.	187	140	.....
Plum Creek, Penn.	142	120	.....
Natrona, Penn.	149	120	160

Rates in cents per ton of 2000 lb.

30171. To establish on (A) **washed or processed silica sand** and (B) **crude silica sand**, carloads, from Millington, Oregon, Ottawa, Sheridan, Utica, and Wedron, Ill., to points in Indiana:

To	Proposed rates A	B	Route
Advance	204	170	3
Alexandria	204	170	1
Anderson	204	170	3
Bluffton	216	180	1
Connersville	240	200	1
Decatur	216	180	1
Elwood	204	170	1
Frankfort	192	160	1
Hartford City	216	180	1
Indianapolis	204	170	1
Kokomo	192	160	2
LaFayette	180	150	1
Marion	204	170	2
Montpelier	216	180	1
Muncie	216	180	1
New Castle	228	190	1
Oxford	168	140	1
Portland	228	190	1
Red Key	228	190	1
Rushville	228	190	1
Tipton	204	170	1
Veedersburg	192	160	1

(Rates in cents per net ton.)

Route 1—C. R. I. & P. or C. B. & Q. R. R., Peoria, Ill., N. Y. C. & St. L. R. R.

Route 2—C. R. I. & P. R. R., or C. B. & Q. R. R., Peoria, Ill., N. Y. C. & St. L. R. R. (through Frankfort and Avery, Ind.).

Route 3—C. R. I. & P. Ry., or C. B. & Q. R. R., Peoria, Ill., N. Y. C. & St. L. R. R., Noblesville, Ind., C. I. Ry.

Present rates, classification basis

30261. To establish on **sand** (all kinds) and **gravel**, in open top cars, carloads, from Akron, O., to Cleveland, O., rate of 60c per net ton. Present, 70c.

30187. To establish on **crushed stone**, in open top cars, carloads, from Lewisburg, O., to Milford, O., rate of 90c per net ton. Present—14c per cwt.

30192. To establish on **crushed stone**, carloads, from Putnamville, Ind., to Coalmont, Ind., rate of 100c per net ton. Present—13c (classification basis).

30211. To establish on **molding sand**, carloads, from Eau Claire, Mich., to Auburn, 139c; Kokomo, Peru, Richmond, Ind., 109c; Cadillac, 227c; Coldwater, 126c; Muskegon, 164c; Owosso, 189c; Port Huron, 214c; Saginaw, 169c, and Holland, Mich., 126c per net ton. Present—300c to Auburn; 320c, Kokomo; 300c, Peru; 400c, Richmond, Ind.; 420c, Cadillac; 300c, Coldwater; Muskegon, 320c; Owosso, 360c; Port Huron, 440c; Saginaw, 400c, and Holland, Mich., 280c per net ton.

30212. To establish on **crushed stone, crushed stone screenings, agricultural limestone or agricultural limestone screenings**, carloads, from Marion, O., to Broadway, Claiborne, Codding, Green Camp, Richwood and Woodland, O., rate of 50c per net ton. Present rate—60c, per Erie R. R. Tariff I. C. C. A-6971.

30214. To establish on **sand and gravel**, carloads (rates in cents per net ton):

To points in Ind.	From Rockport, Ind. A	B	From Cannelton, Ind. A	B
Oakland City	....	....	....	....
Oakland City Jct.	....	....	....	....
Ayrshire	....	....	....	....
Winslow	81	75	86	80
Hartwell Jct.	81	75	81	75
Velpen	81	75	81	75
Stapleton	77	75	81	75
Duff	77	75	81	75
Huntingburg	77	75	77	75

To	From Troy, Ind. A	B	From Toll City, Ind. A	B
Oakland City	....	....	....	....
Oakland City Jct.	....	....	....	....
Ayrshire	....	....	....	....
Winslow	81	75	81	75
Hartwell Jct.	81	75	81	75
Velpen	77	75	77	75
Stapleton	77	75	77	75
Duff	77	75	77	75
Huntingburg	73	73	73	73

To	From Mt. Carmel, Ill. A	B
Oakland City	70	70
Oakland City Junction	73	70
Ayrshire	77	70
Winslow	77	70
Hartwell Junction	77	70
Velpen	77	70
Stapleton	81	75
Duff	81	81
Huntingburg	81	81

A—Present rates.
B—Proposed rates.

30218. To establish on **sand and gravel**, in open top cars, carloads, from Lafayette, Ind., to Foresman, 80c; from Kern to Foresman and Brook, Ind., 90c. Present rates—113c per net ton from Lafayette, Ind., and Kern, Ind., to Foresman, and 13c per 100 lb. from Kern to Brook, Ind.

30222. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) and **gravel**, carloads, from Ashtabula and Ashtabula Harbor, O. To representative points:

*P. & L. E. R. R. Stations	Prop.	Pres.
Struthers, O.	90	100
West Pittsburgh, Penn.	95	110
West Newton, Penn.	130	140
Vanderbilt, Penn.	140	(3)
Glassport, Penn.	120	140
Brownsville, Penn.	140	160
‡P. C. & Y. R. R. Stations		
Woodville Junction, Penn.	140	150
†B. & L. E. R. R. Stations		
Argentine, Penn.	120	(3)
Erie R. R. Stations		
Meadville, Penn.	110	(3)
§W. A. R. R. Stations		
Portersville, Penn.	120	(3)
Bradys Bend, Penn.	130	(3)
¶B. & O. R. R. Stations		
Bakerstown, Penn.	130	160

(Rates in cents per net ton.)

*Via N. Y. C. R. R., Youngstown, O., P. & L. E. R. R.

‡Via N. Y. C. R. R., Youngstown, O., P. & L. E. R. R., McKees Rocks, Penn., and P. C. & Y. Ry.

†Via N. Y. C. R. R., Osgood, Penn., and B. & L. E. R. R.

§Via N. Y. C. R. R., Osgood, Penn., B. & L. E. R. R., Queen Junction, W. Va.

¶Via Youngstown, O., B. & O. R. R.

(3) Sixth class basis.

30224. To establish on **sand and gravel**, carloads, from Anderson, Ind., to Lenore, Gravel Pit, Mt. Perry, 88c; to Francis and Bargersville, Ind., 100c per net ton. Present rates—260c per net ton.

30226. To establish on **sand and gravel**, carloads (to representative points):

	From Portsmouth, Sciotoville, O. Prop.	Pres.	From Sargents, O. Prop.	Pres.
Andressan, W. Va.	140	170	140	170
Brashears, Ky.	.....	.....	.....	.....
Charleston, W. Va.	120	150	130	150
Culloden, W. Va.	110	140	120	140
East Point, Ky.	130	150	140	150
Greasy Creek, Ky.	150	190	160	190
Huntington, W. Va.	100	120	110	120
Lexington, Ky.	150	190	160	190
Melbourne, Ky.	.....	.....	.....	.....
Peach Orchard, Ky.	120	150	130	150
Riverton, Ky.	100	130	110	130
Selbe, W. Va.	140	170	150	170
Sovereign, W. Va.	140	170	150	170
Wayland, Ky.	140	170	150	170

	From Ironton, O. Prop.	Pres.
Andressan, W. Va.	130	*
Brashears, Ky.	.....	.....
Charleston, W. Va.	110	*
Culloden, W. Va.	100	*
East Point, Ky.	110	*
Greasy Creek, Ky.	140	*
Huntington, W. Va.	80	101
Lexington, Ky.	140	*
Melbourne, Ky.	.....	.....
Peach Orchard, Ky.	100	*
Riverton, Ky.	90	*
Selbe, W. Va.	130	*
Soverign, W. Va.	130	*
Wayland, Ky.	130	*

	From Chillicothe, O. Prop.	Pres.	From Gravel Pit, O. Prop.	Pres.
Andressan, W. Va.	160	*	.....	.....
Brashears, Ky.	.....	.....	110	125
Charleston, W. Va.	140	*	.....	.....
Culloden, W. Va.	130	*	.....	.....
East Point, Ky.	150	*	.....	.....
Greasy Creek, Ky.	170	*	.....	.....
Huntington, W. Va.	.....	.....	.....	.....
Lexington, Ky.	170	*	.....	.....
Melbourne, Ky.	.....	.....	90	100
Peach Orchard, Ky.	140	*	.....	.....
Riverton, Ky.	130	*	.....	.....
Selbe, Ky.	160	*	.....	.....
Sovereign, W. Va.	160	*	.....	.....
Wayland, Ky.	160	*	.....	.....

*Combination rates apply.

30245. To establish on **crushed stone, coated with oil, tar or asphaltum** (amiesite), carloads, from Youngstown, O., to Fredericksburg, Va., rate of 440c per net ton. Present—29c.

30248. To cancel B. & O. R. R. (East) Tariff I. C. C. 19654, naming rates on **slag, granulated furnace**, carloads, minimum weight 80% of marked capacity of car, from Pittsburgh, Penn., as shown below, applying in lieu thereof classification basis, viz.: To Buffington, Ind., Chicago, Chicago Heights, Ill., 479c; Cincinnati, O., 378c; Detroit, Mich., 365c; East Chicago, Ind., 479c; East St. Louis, Ill., 580c; Hammond, Indiana Harbor, Ind., 479c; Indianapolis, Ind., 378c; Joliet, Ill., Louisville, Ky., 479c; Madison, Ill., 580c; Mt. Olivet, Mich., 365c; St. Louis, Mo., 580c; South Chicago, Ill., 479c; Statefair, Mich., 365c; Venice, Ill., 580c; Whiting, Ind., 479c per net ton.

30262. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding and silica), and **gravel**, carloads, from Kenneth and Lake Ciecott, Ind., to Brook, Ind., rate of 85c per net ton via P. R. R., Goodland, Ind., C. A. & S. R. R. Present, 13c. (b) To establish on **agricultural limestone, unburned, crushed stone and stone screenings, in bulk**, in open top cars, carloads, from Kenneth, Ind., to Brook, Ind., rate of 85c per net ton via P. R. R., Goodland, Ind., C. A. & S. R. R. Present, 13c.

30279. To establish on **sand and gravel**, in open top cars, carloads, from Kern, Ind., to Kingman, Ind., rate of 70c per net ton. Present, 80c. Emergency charge in addition.

30350. To revise rates on **agricultural limestone**, in open top cars, carloads (See Note 3), from Chicago, Ill., and points taking same rates as shown on page 5, C. F. A. L. Traiff 197-N, to destination territory as described below, viz.: B. & O. stations, Index 155 (Willow Creek, Ind.), to Index 240 (Albion, Ind.), incl.; C. & O. stations, Index 415 (Merrillville, Ind.) to Index 510 (Peru, Ind.), incl.; C. & E. R. R. (E. Sys.) stations, Index 805 (Crown Point, Ind.) to Index 896 (Huntington, Ind.), incl.; C. I. & L. Ry. stations, Index 945 (Zadoc, Ind.) to Index 965 (Dinwiddie, Ind.), incl., and Index 1030 (St. John, Ind.) to Index 1085 (Fair Oaks, Ind.), incl.; C. C. C. & St. L. Ry. stations, Index 1539 (Granger, Ind.) to Index 1590 (Wabash, Ind.), incl.; G. T. Ry. Sys. (West) stations, Index 2065 (Lottaville, Ind.) to Index 2129 (Granger, Ind.), incl.; M. C. R. R. stations, Index 2650 (Willow Creek, Ind.) to Index 2680 (New Buffalo, Mich.), incl., and Index 2715 (Notre Dame, Ind.); N. Y. C. R. R. (West) stations, Index 3210 (Millers Lake Co., Ind.) to Index 3315 (Waterloo, Ind.), incl.; †N. Y. C. & St. L. R. R. stations, Index 3700 (Hobart, Ind.) to Index 3750 (Ft. Wayne, Ind.), incl., and Index 3775 (Michigan City, Ind.) to Index 3830 (Peru, Ind.), incl.; P. R. R. stations, Index 3913 (New Chicago, Ind.) to Index 4030 (Ft. Wayne, Ind.), incl., Index 4060 (Scherville, Ind.) to Index 4145 (Logansport, Ind.), incl., Index 4154 (Nutwood, Ind.) to Index 4206 (South Whitley, Ind.), incl., and Index 4210 (Wallen, Ind.) to 4264 (Howe, Ind.), incl.; P. M. Ry. stations, Index 4405 (Porter, Ind.) to 4480 (New Buffalo, Mich.), incl., Wabash Ry. stations, Index 5260 (Willow Creek, Ind.) to 5330 (Mil-

lersburg, Ind.), incl.; Winona R. R. stations, Index 5700 (Goshen, Ind.) to Index 5760 (Winona Lake, Ind.), incl.; to the same basis as now in effect on crushed stone, gravel and sand (except blast, core, engine filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica). †N. Y. C. R. R. (West) stations, Index 3525 (Olivers, Ind.) to Index 3620 (Shelby, Ind.), incl. Rating and application of rates same as on crushed stone, gravel and sand.

SOUTHERN FREIGHT ASSOCIATION DOCKET

56495. Road building material, viz., **slag, chert, sand, gravel, stone screening** and/or **broken, crushed or ground stone,** to which have been added oil, tar, lime and/or asphalt, carloads, Snow Flake, W. Va., to Appalachia, Big Stone Gap and Rose Hill, Va. It is proposed to establish reduced rates on the above named commodity (See Note 3), from Snow Flake, W. Va., to Appalachia and Big Stone Gap, Va., 310c; Rose Hill, 290c per net ton, made in line with rates which have been established to points in Carolina territory.

56501. **Stone and marble,** viz., **crushed marble or marble chips,** carloads, Bay Harbor, Fla. (import, applicable from shipside), to Albany, Ga. At present, class rate applies. Proposed rate on crushed marble or marble chips, carloads, from and to the above named points, 170c per net ton, same as was proposed under Submittal No. 56041 from Pensacola, Fla.

SOUTHWESTERN FREIGHT BUREAU DOCKET

23955. **Rock, bituminous asphalt,** from points in Missouri and Kansas to interstate points. To establish on rock, bituminous asphalt, as described in Item 4302-F of Supplement No. 150 to W.T.L. Tariff No. 18-M, carloads, minimum weight 80,000 lb., except that when car of less capacity is used for carrier's convenience, actual weight to apply, but not less than 60,000 lb., from Deerfield, Eldorado Springs, Ellis, Hand, Iantha, Lamar, Liberal, Nevada, Swart, Mo., and Pleasanton, Kan., a rate of 15c to Des Moines, Ia., and Lincoln, Neb., and 20½c per 100 lb. to Minneapolis and St. Paul, Minn. Shippers are requesting establishment of rate on the commodity here involved on basis of an 80,000-lb. minimum. There is in effect at present such a basis from Harwood, Mo. However, that basis is not applicable from other producing territory. It is stated that the rates on bituminous asphalt rock from the above producing points are generally on the same basis as Harwood, Mo.

24089. **Stone and rip rap,** from Cape Girardeau and Marquette, Mo., to Hoyleton, Ill. To establish a rate of 105c per ton of 2,000 lb. (not subject to emergency charge) on crushed stone (broken stone ranging in size up to 200 lb. in weight), not including gypsum rock; rip rap (irregular shaped rock), in pieces ranging up to 200 lb. in weight, in straight or mixed carloads (See Note 3), from Cape Girardeau and Marquette, Mo., to Hoyleton, Ill. Proposed rate, it is stated, compares favorably with rates from other producing points and is necessary to permit producers at Cape Girardeau and Marquette to compete with other points of production. Rate proposed to expire eight months after publication.

WESTERN TRUNK LINE DOCKET

496-S. **Limestone, agricultural, ground or pulverized,** in bags, barrels or in bulk, for soil treatment, carloads (See Note 2), from St. Joseph and Heumader Quarry, Mo., on the C. B. & Q. R. R. to C. B. & Q. destinations in Iowa. Rates—Present, class "E" generally. Proposed—Same mileage scale as shown in Docket No. 496-S for distances of 70 mi. and over.

56584. **Sand, gravel, crushed stone, etc.,** carloads, from Bessemer, Gate City and Woodward, Ala., to C. N. & L. R. R. stations. It is proposed to revise rates on sand, gravel, crushed stone, etc., from Bessemer, Ala., Gate City, Ala., and Woodward, Ala., to C. N. & L. R. R. stations to reflect the Docket 17517 scale for the short line distance.

56597. **Marble, crushed, ground or pulverized,** carloads, Tate, Ga., to Cairo and Tamms, Ill. It is proposed to establish reduced rates on marble, crushed, carloads, from Tate, Ga., to Cairo, Ill., $2.93; to Tamms, Ill., $3.53 per net ton. Marble, ground or pulverized, carloads, from Tate, Ga., to Tamms, Ill., $3.60 per net ton.

Amendment 1 to 56325. **Sand, gravel, slag, crushed stone and chert,** from Birmingham, Bessemer, Ensley, Woodward and Mobile, Ala., to East Moss Point, Miss. Submittal No. 56325, included in Docket No. 606, assigned for hearing December 28, 1931, is hereby amended to suggest from Woodward, Ala., the same rate as proposed, from Birmingham, Ala., i.e., $1.65 per net ton.

56667. **Crushed, rubble or broken stone,** carload, High Bridge and Tyrone, Ky., to C. & O. Ry. stations in Kentucky. It is proposed to establish rates on the above named commodities from and to the above named points on basis of mileage scale described in West Virginia Commission Case 1802. Representative rates are as follows: 22 mi., 90c per net ton; 50 mi., 100c; 100 mi., 120c; 130 mi., 140c.; 145 mi., 140c.

56685. **Stone, crushed,** carload, Conyers, Lithonia, Redan and Stone Mountain, Ga., to North Randall and Solon, O. Present rate, 592c per net ton (combination). Proposed rate on crushed stone, carload, from and to the above named points, 442c.—same as currently in effect to Cleveland, O.

56688. **Granite or stone, rubble or crushed,** carloads, Albemarle, Bear Poplar, Cooleemee, Crescent Siding, Granite Quarry, Greensboro, Mt. Airy, Mt. Ulla, Rockwell, Salisbury, Winston-Salem and Woodleaf, N. C., to University, D. C. Present rate—Combination. Proposed rate on granite or stone, rubble or crushed, carloads, minimum weight 60,000 lb., from and to the above-named points, $2.65 per net ton—same as currently in effect to Georgetown, D. C.

7004-E. **Clay, flint** and/or **silica, crude, ground or pulverized,** in bags, barrels, boxes, casks and/or drums, in straight or mixed carloads, or in bulk in straight carloads (See Note 2), but not less than 60,000 lb. Rates in cents per ton of 2000 lb. From Cox and Olive Branch, Ill.

	Pres. rate	Prop. rate
Appleton, Wis.	*	486
Cornell, Wis.	*	569
Rothschild, Wis.	*	486

*Class or combination rates apply.

2161-A. **Sand and gravel** (See Note 2), from Valley and Fremont, Neb., to Omaha and South Omaha, Neb. Rates: Present, 60c per net ton of 2000 lb.; proposed, 45c.

1814-B. **Stone, crushed,** carloads, from Ablemans, Lehrville, Red Granite, Wis., etc., to Peoria and South Pekin, Ill. Rates: Present—Various. Proposed—To restrict Item 3600 of W. T. L. Tariff 6Q so that the rates shown therein will not apply on crushed stone. To publish in Item 2310 of W. T. L. Tariff 6Q, rate of 7c per 100 lb. on crushed stone to Peoria and South Pekin, Ill.

6146-L. **Rules, minimum weight, sand, gravel or stone, crushed,** between stations in Nebraska. Rules, minimum weight, present (See Note 3). In no case shall the minimum weight be less than 40,000 lb. Proposed, to establish the following rule: "When carrier cannot furnish car of weight carrying capacity of dimensions ordered by shipper, and for its own convenience provides a car of greater weight carrying capacity or dimensions than the one ordered by shipper, it may be used on the basis of the minimum carload weight fixed in tariff to apply on class of car ordered by shippers, when the shipment tendered could have been loaded in cars of the size or weight carrying capacity ordered by shippers, but in no case less than actual weight; the weight carrying capacity or dimensions of the car ordered, number of the order and the date of same to be shown in each instance on the bill of lading and the carrier's waybill. But if through oversight this information is not shown on bills of lading and waybills, this rule will apply provided shipper can furnish satisfactory evidence that car of size claimed was actually ordered. In no case shall such shipment be billed on basis of minimum weight for car of less length than owned, leased or regularly in use on the initial line. Under above rules orders will not be accepted for cars of less weight carrying capacity than prescribed by minimum weights governing rates."

7807. **Rates, limestone, crushed,** carload, minimum weight 50,000 lb., from Redford, Ind., to Ottawa, Ill. Rates, present, $2.30 per net ton; proposed, $1.90.

7812. **Rates, sand and gravel,** carload, from Haugen, Wis., to Superior, Wis. Rates, present, 4.6c per 100 lb.; proposed, 4c per 100 lb.

ILLINOIS FREIGHT ASSOCIATION DOCKET

5530. **Phosphate rock** and **phosphatic limestone,** carloads, from Ohio river crossings to points in Colorado and Utah.

From	Rates per net ton to Utah points Pres.	Prop.	To Colorado points Pres.	Prop.
Brookport, Ill.	1500	986	*837	†748
Cairo, Ill.	1500	986	*837	†748
Evansville, Ind.	1500	986	*837	†748
Metropolis Ill.	1500	986	*837	†748
Mounds, Ill.	1620	986	*837	†748

*Per gross ton. †Per net ton.

6278. To establish rate of 30c per ton of 2000 lb. on **stone, viz., crushed or rough quarried,** straight or mixed carloads (See Note 3), but not less than 40,000 lb., from Krause, Ill., to Valmeyer, Ill., to cover plant to plant movement.

6403. **Lime rock or limestone, broken, crushed or ground, carloads** (See Note 1), but not less than 40,000 lb., from Mosher and Ste. Genevieve, Mo., to Ottawa, Ill. Present rate, class; proposed, $1.90 per net ton.

3985. **Sand and gravel,** carload (See Note 3), but not less than 40,000 lb., from Allison Branch, Ill., to Hoyleton, Ill. Present, 11½c per 100 lb.; proposed, $1.13 per net ton.

6404. **Crushed stone, sand and gravel,** carloads, from Joliet, Ill., to Cowden, Holiday and Beecher City, Ill., rates per net ton. Present, $1.26; proposed, $1.13.

5253-B. **Sand, molding,** carloads, (See note 3) but not less than 40,000 lb., from Iola, Ill. Rates in c per net ton.

To	Pres.	Prop.
St. Louis, Mo.	139	127
E. St. Louis, Ill.	139	115
O'Fallon, Ill.	126	115

4939-A. To establish commodity rate of $1.13 per net ton on **sand and gravel,** carloads, usual minimum weight to Beardstown, Chapin and Riggston, Ill., and $1.26 per net ton to Franklin and Virden, Ill., from Pit No. 5 (Crescent) and Pekin, Ill., routing to Beardstown, Chapin, Riggston and Franklin, Ill., via C. & E. I. M. Ry., Havana, J. & H., Jacksonville, Ill., C. B. & Q. R. R., and to Virden, Ill., C. & I. M., Springfield, C. S. & St. L., Waverly, Ia., C. B. & Q. R. R.

I. C. C. Decisions

24727. Empty Cement Sacks. Dewey Portland Cement Co. vs. C. R. I. & P. Rate, returned empty cement sacks, less-than-carloads, Minneapolis, Minn., to Davenport (Linwood) Ia., applicable and not unreasonable but weight applied was excessive to the extent of 1769 lb., Examiner James has ruled. Reparation of $10.79 proposed.

24435. Talc. Missisquoi Pulp and Paper Co. et al. vs. N. Y. C. et al. Rate, talc, from points in New York to Sheldon Springs, Vt., unreasonable to the extent it exceeded or may exceed 19 c., Examiner Garofalo has found. New rate and reparation proposed.

I. C. C. Proposed Decisions

19957. Lime. With a view to removing conflict in I. C. C. decisions, Examiner Williams, on further hearing in 19957, Northwestern Ohio Lime Manufacturers et al. vs. Pennsylvania et al., and the cases joined with it, has recommended that the Commission find unreasonable the rates on lime, from producing points in Maryland, Pennsylvania, the Virginias and Ohio to central territory. He has further recommended that the rates on lime, from producing points in Ohio to destinations in trunk line and New England territories, be found not unduly prejudicial or unreasonable in the past but unreasonable for the future, that reasonable rates be prescribed for the future, and that the former reports, 112 I. C. C. 7, and 159 I. C. C. 9, be modified in part.

The cases joined with this one are: 16170, Eastern Lime Manufacturers Bureau et al. vs. Akron and Barberton et al. and a subnumber, Washington Building Lime Co. et al. vs. Same; 19951, Ohio Hydrate and Supply Co. vs. Pennsylvania et al.; 20234, Acme Glass Co., Inc., vs. Pennsylvania, and a subnumber, Berney-Bond Glass Co. vs. Same; 20246, Washington Building Lime Co. vs. Same, and a sub-number, Same vs. Same.

In the Eastern Lime Manufacturers Bureau case, 112 I. C. C. 7, the examiner said the Commission found that the rates on common lime, hydrated, quick or slaked, except agricultural and fluxing lime having no commercial value for building or chemical purposes, carloads, minimum 30,000 lb., from producing points in Maryland, Pennsylvania, the Virginias and Ohio to central territory were unreasonable. It also found, Examiner Williams said, that the rates on agricultural and fluxing lime were unreasonable to the extent they exceeded 80% of the rates prescribed on the other sorts of lime. In Northwestern Ohio Lime Manufacturers vs. Pennsylvania, 159 I. C. C. 9, called the Ohio Lime case, division 3, found that the rates on all sorts of lime, from points in Ohio to trunk line and New England territories, were

neither unreasonable nor unduly prejudicial in the past, but would be unreasonable for the future.

The Commission, in other words, said the examiner, in the Eastern Lime case prescribed rates on fluxing and agricultural lime on the basis of 80% of the rates on building or chemical lime, but that in the Ohio case, division 3 denied the complainants' request for a lower basis on their fluxing lime. Division 3 said the record did not warrant lower rates on fluxing lime.

On petition of the Ohio Lime complainants the cases were reopened for further hearing. The railroads, respondents in the Eastern Lime case, said that Ohioans were misbilling their product as fluxing lime.

Examiner Williams recommended the technical findings hereinbefore mentioned and then said that maximum reasonable rates on lime, in the areas described in the first paragraph, would be 80% of the rates contemporaneously applicable on lime, minimum 30,000 lb., the 80% rates, however, being applicable on a minimum of 50,000 lb.

Southwestern Stone Case

THE Interstate Commerce Commission has called a procedural conference, in Washington on February 4, between Examiner Mattingly and those interested in I. and S. No. 3130, part 11, stone, southwestern rates. The object is to arrange a tentative program for the hearing in Washington on February 16. Following the conference, says a notice issued by the Commission, a tentative program will be made public through the press.—*Traffic World.*

No Increase in Mississippi Sand and Gravel Rates

SURCHARGES asked by the Interstate Commerce Commission on intra-state shipments in Mississippi, were approved January 16 with the exception of the sand and gravel rates, by the State Railroad Commission.

The increase goes into effect in 10 days, January 26.

The surcharge on sand and gravel was refused on the protest of the State Highway Commission and gravel shippers, who pointed to the proposed expansion of state highways, which they said might be affected by higher freight rates, which would necessarily be passed on to taxpayers.—*Columbus* (Miss.) *Dispatch.*

Gets Reduced Agricultural Lime Rate

COUNTY AGENT Francis of Ewen, Mich., has made the following announcement:

A low rate on lime shipped from the Union Carbide Co. at Sault Ste. Marie has been secured for farmers in Ontonagon county.

The rate has been reduced from 90 c. to 60 c. per ton. In addition to this there is a charge of $5 per car for loading and $4 per car for switching. In order to secure lime at these rates it is necessary to have the lime shipped to the county agent because of the railroad tariff regulations.

During the past two years the agricultural agent has secured about 50 carloads of lime for farmers in the county without any freight charges.—*Houghton & Calumet* (Mich.) *Gazette.*

Sue for Breach of Contract

CHARGING failure to meet terms of a legal agreement reached two years ago, the National Quarries Co. of Lima, Ohio, has filed suit against the Detroit, Toledo and Ironton railroad for damages of $221,200. In a petition filed in the Allen county common pleas court, the quarry company alleges that at the close of litigation which followed an attempt of the railroad company to gain possession of the quarry, the railroad agreed to strip approximately 352,000 cu. yd. of dirt from the quarry property. The plaintiff charges the railroad has removed only 36,000 yd. of dirt and now declines to continue.

The litigation started in 1927 when the railroad, then owned by Henry Ford, attempted to gain possession of the quarry. When negotiations for purchase failed, the railroad started condemnation proceedings, claiming it needed the quarry property in connection with its project of straightening the railroad line between Lima and Cairo. In 1928 an order was signed in Allen common pleas court enjoining the quarry company from continuing operations pending a decision on the condemnation proceedings. As evidence of good faith the railroad was required to post a bond of $100,000. The railroad company, however, abandoned its reconstruction plans and in lieu of forfeiting its bond agreed to strip dirt from the quarry.

The quarry has continued its operations since the injunction was dissolved and claims that abrogation of the contract by the railroad would make it necessary for the quarry company to strip the dirt down to bed rock at its own expense. The cost of removing the remaining 316,000 yd. of dirt which the railroad company agreed to remove will total $221,200, the quarry officials charge in their petition.—*Lima* (Ohio) *Star.*

Marquette to Extend Barge Service

PLANS for extending its barge line service from Memphis, Tenn., to Vicksburg, Miss., and erection of a $100,000 distributing plant at Vicksburg have been announced by F. L. Jaeger, division manager of the Marquette Cement Manufacturing Co.

The company plans to build new barges or lease some from the Federal Barge Line.

The company is now operating one towboat and four barges on this section of the Mississippi. This number probably will be increased to 9 or perhaps 12, Mr. Jaeger said.—*Memphis* (Tenn.) *Press-Scimitar.*

Sand-Lime Brick Production and Shipments in December

THE FOLLOWING DATA are compiled from reports received direct from 19 producers of sand-lime brick, located in various parts of the United States and Canada. The number of plants reporting is two less than for the November estimate, published in the December 19 issue. The statistics below may be regarded as representative of the industry in the U. S. and Canada.

The figures received for the month of December show decreased production and rail and truck shipments, undoubtedly due to the general inactivity in construction. Stocks on hand and unfilled orders also show decreases in comparison with the previous month.

Average Prices for December

Shipping point	Plant price	Delivered
Dayton, Ohio	$11.50	$12.50
Detroit, Mich.	13.00	14.50-15.50
Grand Rapids, Mich.	.....	13.50
Jackson, Mich.	13.00	.....
Madison, Wis.	12.50	14.00
Milwaukee, Wis.	8.00	10.00-12.00
Minneapolis, Minn.	7.50	10.00
Pontiac, Mich.	12.50	14.50
Saginaw, Mich.	11.50	.....
Sioux Falls, S. D.	12.00	.....
Syracuse, N. Y.	18.00	20.00
Toronto, Ont., Can.	9.90	12.00

Statistics for November and December

	†November	*December
Production	4,238,525	3,117,580
Shipments (rail)	647,600	397,240
Shipments (truck)	4,604,282	3,630,165
Stocks on hand	10,529,126	8,676,979
Unfilled orders	10,485,000	8,745,000

†Twenty-one plants reporting. The figures include statistics from one plant not received in time for inclusion in the figures published in the December 19 issue; incomplete, one not reporting production and ten not reporting unfilled orders.

*Nineteen plants reporting. Incomplete, two not reporting production, two not reporting stocks on hand, and ten not reporting unfilled orders.

New Marine Transportation Company in East

ANNOUNCEMENT has been made of the formation of the Interports Transportation Corp., New York and Boston, to handle the transportation of stone and other bulk materials between New York harbor and New England ports.

The new company takes over the business of Bee Line Transportation Co., Boston and New York, and will be closely affiliated with Moran Towing and Transportation Co., Inc., New York.

By combining the facilities and equipment of these two companies the new company will be able to give even better service. The combined equipment comprises 85 major units made up of 63 scows, barges and lighters and 22 harbor and coastwise tug boats.

It is planned to materially increase the number of communities served both in New England territory and in New York and New Jersey communities bordering on New York harbor.

New York State Crushed Stone Association Discusses Washing Stone

A REGULAR MEETING of the New York State Crushed Stone Association was held at Pittsburgh, Penn., Wednesday evening, January 20. This was presided over by J. L. Heimlich, Le Roy Lime and Crushed Stone Co., Le Roy, N. Y., who was chosen president at the previous meeting.

The committee of which A. G. Seitz is chairman reported further on the conferences with the highway department at Albany on the matter of compulsory washing of stone and required screen sizes, from which it appears that washing will be required, although apparently the matter is not entirely cleared up. In changing from round to square holes for determination of stone sizes on the new specifications some modifications were to be made by the department so as not to work a hardship on the producers.

By motion of the meeting the dues to the association are to be changed slightly so that in addition to the $5 annual dues paid by each individual member, dues of $10 per year for each producer company with an output of less than 100,000 tons annually and of $25 per year for producers having an output of more than 100,000 tons, are to be assessed.

The time and place of the next meeting will be announced later by the president.

Annual Convention and Exposition of American Road Builders' Association

THE 29th annual convention and exposition of the American Road Builders' Association was held in Detroit, Mich., January 11-15. Attendance is reported to compare favorably with that of 1931.

Following a reception on Sunday, honoring delegates from Canada, there were four days of rapid-moving meetings in which were discussed and reviewed all phases of road building.

Perhaps one of the livest sessions of the convention was a round-table publicity conference on highway program extension. Such questions as "What is the extent of opposition to road and street improvements?"—"What plans for highway extension publicity now exist?"—"What is the most logical plan for highway extension?" and "What methods of approaching the public are now most desirable?" were discussed thoroughly.

These discussions were led by the following men: C. R. Thomas, publicity director, American Road Builders' Association, Washington, D. C.; E. M. Fleming, manager, Highways and Municipal Bureau, Portland Cement Association, Chicago, Ill.; Wm. S. Power, Campbell-Ewald Advertising Agency, Detroit, Mich.; Richard Harfst, general manager, Automobile Club of Michigan, Detroit, Mich.; C. M. Upham, engineer-director, American Road Builders' Association, Washington, D. C.; Malcolm Bingay, editorial director, *Detroit Free Press,* Detroit, Mich.; E. E. Duffy, assistant manager, General Educational Bureau, Portland Cement Association, Chicago, Ill.; H. E. Samuelson, information director, Department of Highways, St. Paul, Minn.; W. H. Taylor, Campbell-Ewald Advertising Agency, Detroit, Mich.; W. S. Gilbreth, vice-president, Automobile Club of Michigan, Detroit, Mich.; C. L. Van Auken, vice-president, Kenfield-Davis Publishing Co., Chicago, Ill.; V. J. Brown, associate editor, *Roads and Streets,* Chicago, Ill.; F. J. Benjamin, editor, *Highway Engineer and Contractor,* Chicago, Ill., and George E. Martin, the Barrett Co., New York City.

It was disclosed that we now have in the United States only 700,000 miles of improved roads and that there are 2,500,000 miles of unimproved roads; that more than half of the farms in the United States are located on mud roads; that approximately one hundred million dollars of gasoline tax is diverted annually to channels other than road building. The fact that it is necessary that the general public approve the development of good roads was forcefully presented.

The exposition in the Municipal Airport Building was made up of exhibits of all kinds of road building machinery and equipment. Manufacturers from all over the United States displayed their latest models, from hand shovels to (small) power shovels and motor trucks. There was an extremely large showing of motor trucks, indicating the rapidly increasing use of them in road building.

To Hold Mineral Conference

POINTING OUT that an industry with products and derivatives amounting to approximately $240,000,000 annually is well worthy of the attention and support of Illinois business men, the Illinois Chamber of Commerce is urging attendance at the mineral industries conference to be held at La Salle, Ill., on February 5.

The meeting will have the threefold purpose of urging a complete investigation into the composition and potential economic possibilities of all mineral and rock substances occurring in Illinois; of providing for the study of production and movements of mineral materials both into and out of the state, and of all possible marketing opportunities.

Four speakers well known in the mineral industries field will discuss the present relative position of Illinois mineral industries. They are C. C. Whittier, consulting engineer of the Robert W. Hunt Co.; M. M. Leighton, chief of the state geological survey; H. S. Ray of the Rock Island lines, and W. Y. Wildman of the Illinois coal traffic bureau. These men will discuss changes taking place in the construction industry due to research, the new development program of the state geological survey, the rock products industry, and the state's coal industry.—*Chicago* (Ill.) *Tribune.*

Program of American Institute of Mining and Metallurgical Engineers

A PRELIMINARY announcement of the program of the American Institute of Mining and Metallurgical Engineers' 141st meeting, to be held in New York, February 15-18, has been issued.

The following papers of interest to the rock products industry will be read:

On Mining Methods: (Monday and Tuesday morning) Sampling and Exploration of Deposits by Means of Hammer Drills, by J. B. Knaebel; and The Room and Pillar Method Applied to Nonmetallic Deposits, by J. R. Thoenen.

On Milling Methods: (Monday morning and afternoon) Soap Flotation of Nonsulfides: Limestone, Phosphate Rock, Bauxite, Fluorspar, Rhodochrosite, Barite and Others, by W. H. Coghill and J. Bruce Clemmer; Studies of Efficiency of Ore Crushing and Grinding, by John Gross; Relation of Fineness of Grinding to Mill Capacity, by A. W. Fahrenwald; and The Explosive Shattering of Minerals, by R. S. Dean and John Gross.

On Nonmetallic Minerals: (Wednesday morning and afternoon) Mineral Wool Resources of Indiana, by W. N. Logan; Soap Flotation of the Nonsulfides; Limestone, Phosphate Rock, Bauxite, Fluorspar, Rhodochrosite, Barite, Siderite and Cyanite, by Will H. Coghill and J. Bruce Clemmer; Magnetic Beneficiation of Nonmetallics, by Samuel Gilson Frantz and G. W. Jarman, Jr.; Uniform Cost Accounting in the Crushed Stone Industry, by William E. Hilliard; Quarry Waste in the Indiana Limestone District, by J. B. Newsom; The Geology of Some Kaolins of Western Europe, by Ernest R. Lilley; Mineralogy of the Potash Mine Near Carlsbad, N. M., by W. T. Schaller; and Geology of Molding Sand Deposits, by David W. Trainer, Jr.

A diversified program of 18 papers is the offering of the Committee on Geophysical Prospecting, and throughout the wide range of subject matter there is much of both theory and practice for the geophysicist and the geologist. Three of the papers have a direct interest for the petroleum geologist. There will be three sessions, Monday morning and afternoon and Tuesday morning, respectively.

Organize to Promote Magnesium Development

THE Aluminum Co. of America and the I. G. Farben Industrie A-G of Germany, acting jointly, have formed the Magnesium Development Co. of America, to promote the development and utilization of magnesium.

It is expected that the new company will have the advantages of technical experience and will own patent rights of the companies.

Walter S. Duisberg will be the head of the company and its board will be selected by the controlling companies.—*Cleveland* (Ohio) *News.*

Approves Tariff Recommendations on Cement or Cement Clinker

THE PRESIDENT has approved the report of the tariff commission, with respect to Roman, portland, and other hydraulic cement or cement clinker, which indicates that the rate of duty fixed by the tariff act of 1930, namely 6c per 100 lb., including the weight of the container, equalizes the difference in the costs of production, including transportation and delivery to the principal markets in the United States of the comparable domestic and imported article.

The commission instituted this investigation on June 20, 1930, in compliance with Senate resolution 295, dated June 18.

The investigation shows that in recent years about 98% of the annual production of hydraulic cement consists of the portland variety. Little, if any, hydraulic cement other than portland cement is imported. The domestic production of portland cement increased during each year from 1921 to 1928, rising from 99 million bbl. in 1921 to 162 million bbl. in 1925, and 176 million bbl. in 1928. Production in 1929, the year covered by the investigation, decreased to 170,646,000 bbl., and in 1930 it was 161,197,000 bbl. Imports of hydraulic cement, including that entered at Hawaii and Porto Rico, rose from 324,000 bbl. in 1922 to 3,655,000 bbl. in 1925, in which year they were equal to 2.2% of domestic consumption. Imports decreased after 1925, and in 1929 imports of finished cement amounted to 1,254,000 bbl., and of cement clinker 474,000 bbl., a total of 1,728,000 bbl., equal to a little over 1% of the domestic consumption. During the 12 months, July 1, 1930, to June 30, 1931, under the duty of 6c. per 100 lb., total imports of cement including those shipments entered at Hawaii and Porto Rico, amounted to 617,859 bbl., of which imports into continental United States constituted 412,738 bbl.; no cement clinker was imported during this period. The imports into continental United States during 1929, including clinker, were equivalent to about 1¼% of the production of domestic plants located in areas more or less close to the coast and which supply coastal points; the corresponding proportion during the period July, 1930-June, 1931, was about ½ of 1%. The sale in the United States of imported portland cement clinker was a comparatively recent development, and prior to 1930 none of the similar domestic product was sold by producers of cement. In 1929 Belgium was by far the largest exporter to the United States of portland cement and cement clinker. Imports of these products from Belgium in 1929 were approximately 69% of the total imports and about 79% of total imports into continental United States. Domestic exports of portland cement in recent years have averaged annually about 850,000 bbl., or approximately ½ of 1% of domestic production. A considerable proportion of the exports consists of white portland cement, a special high-grade cement largely non-competitive with the ordinary standard portland cement. Exports have been principally to South American and Central American countries, Cuba, and Canada.

The investigation shows that the domestic plants in the cement producing areas adjacent to the coasts which ordinarily supply large markets on the coast are the only ones directly affected by competition from the imported cement.

Costs of production including transportation and other delivery charges to the principal markets in the United States for the plants in these areas were used for comparison with the corresponding costs obtained from cement plants in Belgium. Costs were obtained for the year 1929.

Domestic costs were also obtained for plants in the six interior districts and are shown in the report. While these costs at plant were almost the same as costs at plant in the coastal areas they were not used for comparison with foreign costs.

Costs of the partly finished product, portland cement clinker, were obtained for one domestic plant in southern California and for one plant in Belgium.

Upon consideration of the facts obtained in this investigation, the commission found (one commissioner dissenting) that the present rate of duty fixed by the Tariff Act of 1930 on Roman, portland, and other hydraulic cement or cement clinker, namely, 6c per 100 lb., including the weight of the container, equalizes the difference in the costs of production, including transportation and delivery to the principal markets in the United States.

To Complete Sand Plant in Kentucky

THE FIRST real move toward better times in the vicinity of Olive Hill, Ky., was the announcement recently that the Tavern Rock Sand Co., of Charleston, W. Va., had begun and would rush to completion its sand plant at Lawton. Once before it started this building and the depression stopped the work, but this time it will be built, so says the foreman, G. A. Saulsberry, who will have charge of the work. It is reported this plant will cost $250,000.

The above company has invested several thousand dollars in this county, and while it will only prepare and ship sand at the present time, it is generally conceded, owing to the high quality of this sand, it will soon erect a glass plant there where it can secure cheap labor and manufacture glass cheaper than it can mine and ship its sand so far.

This concern now owns more sand in this county than almost anywhere else, and, according to the *Olive Hill* (Ky.) *Herald*, it is far better in quality.

Still Believes Cement Industry a Monopoly

THE EXISTENCE of an "absolutely illegal monopoly" within the cement industry was charged in the Senate January 17 by Senator Norris of Nebraska.

Senator Norris made his charge while the Senate was debating an appropriation to continue the Federal Trade Commission's investigation of the industry. He said he was afraid the commission "would not get the truth" because of the technical and legal objections which had been raised.

"We have got to stop splitting these legal hairs," he said, "if the country is to learn the facts."

Senator Norris said the information about the cement industry would be worth ten times the cost of the investigation, if it could be obtained.—*Newark* (N. J.) *Call.*

Drop in Pound Lets in British Cement

AS A RESULT of depreciation in the pound sterling, British cement is being shipped into the New York City market in quantity for the first time in years.

One cargo of cement from England was reported to have been landed on the Atlantic seaboard already, with four more cargoes en route. Depreciation of sterling has been great enough to overcome a tariff of 23 c. a bbl. imposed on foreign cement.

Import of British cement was considered the more interesting for the fact that cement prices in this country have fallen to unprofitable levels for domestic producers. The cement industry has been particularly hard hit by depression, and the general fall of prices.—*New York* (N. Y.) *Post.*

This foreign product is understood to have been sold at around $1.35 per bbl. packed in paper containers, as compared with the current domestic quotation of $1.54 per bbl. It is the belief of American manufacturers that if importations continue it will be necessary for them to establish a "depressed price" in this market to meet the competition. Such a price has been in effect in Boston for the past several years where it has successfully competed with Belgian importations which at one time threatened to eliminate the American product from the district.

For the nine months of 1931 ended with September, cement imports for the entire country totaled 357,617 bbl. The low point of 9760 bbl. was reached in August, September's imports aggregating 33,575 bbl. Of that month's total, 22,604 bbl. came from Belgium—only 13 bbl. having arrived from Great Britain.

The sharp rise in imports from Britain reflects lower production costs in England due to the abandonment of the gold standard. American producers estimate that the depreciation in sterling exchange recently has lowered British costs by as much as 25%.—*Wall Street Journal* (New York).

To Build Monazite Plant

THE MONAZITE INDUSTRY will be revived soon in Rutherford county, N. C., according to plans now under way. Frank R. Porter, of the Porter Placer Mining Co., of Los Angeles, Calif., has been in the county some time working on the project. The plant will be located near Bostic, the *Asheville* (N. C.) *Citizen* reports.

Mr. Porter has had 35 years experience in the mining business. He plans to erect a large and modern monazite plant at Broad River near Bostic. Mr. Porter has contracted with G. Bryan Harrill of Forest City for five acres of land at the site. Mr. Porter plans to have the plant in operation not later than April 1. The plant will pay the farmers $25 per ton for monazite sands.

More than 25 years ago the German-American Monazite Co. had a plant located between Ellenboro and Hollis which ran for several years. The late Lawson A. Gettys, of Shelby, was interested in that plant.

Due to the discovery of large deposits of monazite in Brazil and Ceylon, Congress several years ago removed the duty on monazite and the price dropped from 8 to 1c.

Mr. Porter says there is more monazite in this section of the Carolinas than in any other part of the world.

The *Henderson* (N. C.) *Times* reports that in addition to operating a central plant, Mr. Porter will conduct a financing department which will make loans to owners of small mines for their output and in turn contract to purchase their output for treatment at the monazite plant.

[Monazite sand is the chief source of thoria, a rare metallic element.—THE EDITOR.]

To Build Sodium Sulphate Plant

WORK WILL BEGIN soon on the construction of a $25,000 sodium sulphate plant near Monse, Wash., according to dispatches from Spokane. C. W. Beardmore of Priest River, Ida., is given as authority for the statement. The plant will be one unit of a huge paper pulp mill, the main part of which will be built at Priest River as soon as conditions improve.

Decision to go ahead with the plant at Monse was reached when it was found there is an existing market for the material at a fair price now.

Thirty tons of sodium sulphate will be turned out each day. The company owns an unlimited supply of the raw material in dry lake beds near Monse on the Colville reservation.—*Wenatchee* (Wash.) *World.*

To Make Super Cement

THE Dewey Portland Cement Co., Kansas City, Mo., announces it has acquired the rights to use the "Super" cement process. The product will be marketed as Dewey super cement.—*Kansas City* (Mo.) *Retail Lumberman.*

To Convert Lime Plant for Dry Ice Production

PLANS FOR REOPENING of the old Cajon Lime Products Co. plant northwest of San Bernardino, Calif., were speeded up by the return of Loren O. Foreman, head of the syndicate preparing to revamp the plant and enter production of dry ice.

Mr. Foreman has been in the east, arranging for financing of the new industry.

Under the plans of Mr. Foreman and his associates, the plant is slated for remodeling, with abandonment of its original cement and lime production, in favor of manufacture of the new refrigerating product.

Production of dolomitic hydrated lime is also planned at the new San Bernardino industrial plant when it gets under way in the near future, B. O. Bricker, who is financially interested, said.

The firm name of the organization preparing to operate in Cajon Pass is the Dry Refrigeration Chemical Co., Ltd. The concern is said by Mr. Bricker to have paid approximately $270,000, with improvements slated to involve an additional $200,000. Holdings include 420 acres of mineral lands besides the industrial plant itself. Until this year the plant was controlled by R. W. MacGillvray.—*San Bernardino* (Calif.) *Sun.*

Buys Mineral Lands in North Carolina

FOUR THOUSAND ACRES of mineral lands, containing vast deposits of feldspar, mica and kaolin, and located in Avery and Mitchell counties, N. C., have been purchased from the J. Walter Wright Lumber Co., of Bristol, Tenn., by Howard D. Marmon, of the Marmon Motor Co., C. R. Ricker, of New York and Spruce Pine, and others, for $100,000.

Although the purchasers of the property have made no announcement of their plans for the future, it is understood that plans are under way for the extensive development of the mineral deposits found on the property.

For the past three or four months from 25 to 30 men have been employed by the new owners of the property in making tests of the mineral deposits. The tests show, it is stated, that the property contains one of the largest, if not the largest, deposits of kaolin found in the United States. The kaolin is said to be superior to the English clay.

Between $15,000 and $20,000 has been expended in making the investigations and tests on the property, it is stated. Tests have been made to a depth of 80 ft. on one tract.

The purchase of these mineral lands is looked upon here as another indication of the importance of this section as a mining center. For years, kaolin, mica and feldspar have been mined in this section on an extensive scale, and a number of plants have been erected in this section in recent years by leading mineral producing companies.—*Spruce Pine* (N. C.) *News.*

New Company Buys Oregon Gravel Plant

PURCHASE of the plant of the Glenwood Sand and Gravel Co., located between Eugene and Springfield, Ore., by a new company that is in the process of formation, was announced December 18 by D. F. Skene, owner of the Title Abstract Co. and who is largely interested in the new concern, to be known as the Lane County Sand and Gravel Co.

Mr. Skene said that articles of incorporation are now being prepared and that the new company is capitalized at $75,000. A number of local business men whose identity he does not care to reveal at this time are interested with him in the project.

A contract to furnish all the sand and gravel for use in the concrete work in building the new city water filtration plant now under construction has been given the new company, according to Mr. Skene. The plant has recently been rebuilt and the work of getting out this large order of material was made late in November but no publicity was desired until articles of incorporation were filed, Mr. Skene stated.

The property on which the sand and gravel plant is located was owned by W. O. Feenaughty of Portland and this tract as well as the machinery and bunkers operated by the Glenwood company has been taken over by the new company. E. C. Wilfert was head and general manager of the Glenwood company and had operated the plant at its present location for the past six years. He had a lease upon the land. A large gravel bar exists in the river at this point and it is estimated that there is enough gravel there to last for many years.—*Eugene* (Ore.) *Register Guard.*

Now Owns All But Danish Cement Cooperative

IT HAS BEEN ANNOUNCED that the Nrresundby portland cement factory of Denmark has been ceded to F. L. Smidth and Co. (Ltd.), which is now the owner of all Danish cement factories except the Danish Cooperative.

The Nrresundby has a yearly capacity of 900,000 bbl. of cement; it was originally started to provide cargo for the ships of the East Asiatic Co., but nearly all cement plants have been obliged to limit production during the recent years of depression, and a close cooperation between the plants still operating was considered advisable.

Preparing for Production

THE Mayflower Gravel Mining Co., George L. Duffey, Forest Hill, Calif., superintendent, has completed 26 mi. of ditches and flumes to bring water to its property. It has its own power plant and is reported to have a large deposit of excellent gravel which will be marketed.

Report Edison Cement Corp. Interested in Cement Plant Negotiations

IT was recently reported that plans for the early completion of the Building Materials Corp. plant on Raritan river in Piscataway town, as a portland cement plant to be managed and operated by the Edison Cement Corp., have now reached the point where Thomas A. Edison, Inc., is willing to provide the financing for such an undertaking if a satisfactory adjustment of the Raritan (N. J.) township taxes against the plant can be arranged.

The township commissioners are following up these negotiations actively, as they fully appreciate the desirability of the conversion of this idle property into an active Edison enterprise with labor payrolls alone which will probably exceed $250,000 annually, according to reports.

This is the first authentic information that the Edison interests have taken an active part in the negotiations looking toward a reopening of the plant. Several proposals have been offered to the township authorities in the past for an adjustment of the back assessments against the property, and they have been assured that if such an adjustment could be made the plant would be reopened as a cement production enterprise, but the interests behind these proposals have been carefully concealed up to the present. [In the July 18 issue, ROCK PRODUCTS told of a proposed reorganization.—THE EDITORS.]

It is understood that the sponsors of the plan to reopen the plant are most anxious to expedite the solution of their differences with the taxing authorities by a settlement out of court, if possible, as the pending litigation is likely to prolong the final adjustment for an indefinite period. The plant is reported to be in condition to be reopened on very short notice, and the sooner the tax matter has been solved, the sooner it can be put back in operation as a going concern.—*New Brunswick* (N. J.) *News.*

H. R. Albion Appointed by Cement Association

ANNOUNCEMENT has just been made by the Portland Cement Association of the appointment of Henry R. Albion as assistant manager, eastern offices, with headquarters in Atlanta, Ga.

Mr. Albion entered the field promotion work of the Association in Florida in 1926 and was appointed district engineer in charge of Association activities in that state in 1927.

Mr. Albion received his schooling in South Dakota, where he attended the State School of Mines at Rapid City. For several years he was senior partner of the engineering firm of Albion and Ewing.

In his new capacity Mr. Albion will serve as assistant to J. R. Fairman, manager of the eastern offices of the Portland Cement Association.

New Crushed Stone Plant in Kentucky

THE Grayson Limestone Products Co., Leitchfield, Ky., will begin operations soon at its quarry there.

The new company, headed by L. N. Shenk, who has had 40 years of experience in producing and handling stone for all kinds of construction work, will specialize in crushed stone for highway surfacing and agricultural lime, both crushed and burned.

A number of farmers have already placed orders for several hundred tons of the burned and crushed stone which under official tests showed 97% $CaCO_3$. The supply of stone on hand is practically unlimited.

The company will prepare demonstrations of the value of lime on land near its quarry, and also show the difference in the value of burned lime and crushed lime.

Sherrill McClure is secretary and treasurer of the Grayson Limestone Products Co. This report from the *Leitchfield* (Ky.) *Gazette* also states special buying arrangements have been worked out.

Saluda Crushed Stone Co. Buys Georgia Quarry

THE Saluda Crushed Stone Co., Greenville, S. C., has purchased the real estate and a portion of the machinery of the Elberton Quarries, Inc., at Elberton, Ga., and is making preparations to begin working the quarries on a big scale at an early date, it was recently reported. — *Elberton* (Ga.) *Star.*

Road Chief Receives Award

BECAUSE of his outstanding contribution to highway progress, Thomas H. MacDonald, chief of the U. S. Bureau of Public Roads for the last 12 years, has been presented the newly established George S. Bartlett Award (ROCK PRODUCTS, May 23).

The presentation was made at the opening session of the annual meeting of the American Road Builders' Association, which this year was held in Detroit.

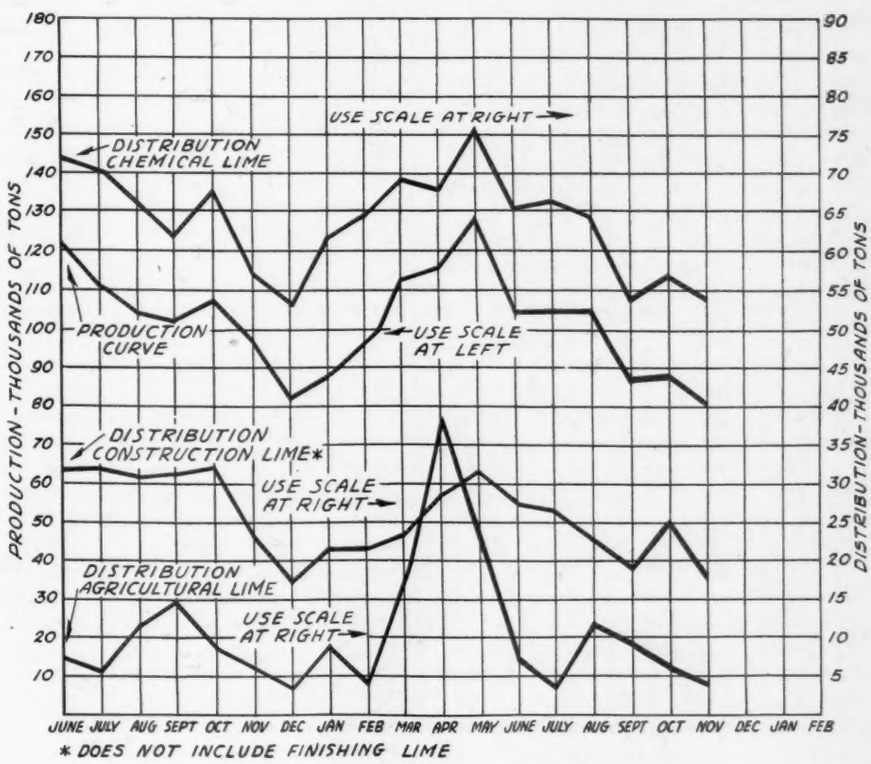
Mr. MacDonald's professional life has been devoted entirely to the cause of better highways since his graduation from Iowa State College in 1904. That year he began as an assistant in the newly created Iowa State Highway Commission. Shortly he became chief engineer of the commission.

When in 1919 a new leader was needed for the U. S. Bureau of Public Roads, Mr. MacDonald was appointed as the chief of this bureau by Secretary of Agriculture Houston.

Production and Distribution of Lime

THE ACCOMPANYING CHART shows statistics of operations in the lime industry for a 17-month period ending with November, 1931.

This information, supplied by the National Lime Association, represents only 43% of the total lime production of the country. Reasonable accuracy in estimating total production should be obtained from it by doubling the amounts shown in the chart.


USE SCALE AT RIGHT
DISTRIBUTION CHEMICAL LIME
PRODUCTION CURVE
USE SCALE AT LEFT
DISTRIBUTION CONSTRUCTION LIME*
USE SCALE AT RIGHT
DISTRIBUTION AGRICULTURAL LIME
USE SCALE AT RIGHT
PRODUCTION - THOUSANDS OF TONS
DISTRIBUTION - THOUSANDS OF TONS
JUNE JULY AUG SEPT OCT NOV DEC JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT NOV DEC JAN FEB
* DOES NOT INCLUDE FINISHING LIME

Operations of lime industry for 17 months

Crushed Stone Producers Gain Much Information and Inspiration

Pittsburgh Convention of the National Crushed Stone Association an Unqualified Success

IN THIS REPORT of the Fifteenth Annual Convention of the National Crushed Stone Association, held at the William Penn Hotel, Pittsburgh, Penn., January 19 to 22, inclusive, we will depart from the usual chronological method of reporting and also somewhat from our former method of grouping the report under specific headings. We are doing this because of the nature of the convention, itself, and because we wish to place the emphasis on the things that we believe it was the intention of the Association to place emphasis.

Therefore, the report is treated under the following rather broad headings in their approximate order of importance as evidenced at the convention: (1) Industry, society and government—in general; (2) the National Crushed Stone Association—and how it is meeting its problems; (3) investigations and research; (4) washing and cleaning crushed stone; (5) stone sand; (6) ready mixed concrete; (7) railway ballast; (8) airport construction; (9) agricultural limestone; (10) operating problems.

At this convention (we feel certain it was the practically unanimous opinion) the major problems of industry and society in general loomed more important in the program than anything else; and second in importance unquestionably were the various reports and papers relating to the activities of the Association, probably intended to answer the challenge that modern conditions have placed before all trade association managements.

Business Conditions in the Stone Industry

The reports of the business conditions by the directors of the Association indicated a general falling off in the tonnage of crushed stone produced in 1931 of as much as 50% in some sections with generally lower prices prevailing. The eastern section of the country was apparently less affected as to decreased output and lower prices than other sections. No improvement for the first part of the present year was predicted by those reporting and any improvement predicted was based largely on faith in an improvement in general business conditions rather than by any very tangible factors in the crushed stone industry alone.

In general the reports of the directors corroborated the analysis of the industry given in Rock Products' Annual Review Number, January 9. And while one would find it difficult to truthfully reflect these reports in a very optimistic vein, it was entirely evident that the quarry industry has suffered far less than many others, both in loss of volume and in reduction of prices.

In all probability the bulk of the business of the crushed stone industry in the next year or two will come from continuation of the highway improvement program, and this subject was treated from several angles in the course of the convention.

FROM REPORTS at the convention it was evident that the quarry industry has suffered far less than many other industries during 1931. Construction of highways will produce an important part of the market for the products of this industry in 1932. Coordinated effort to maintain public interest in highway building is important to prevent diversion of road building funds to other uses.

Stabilization of Highway Building

Ex-Governor John S. Fisher of Pennsylvania spoke at great length on the early history of the good roads movement in Pennsylvania and his part in it, and made it clear that there was plenty of justification for the roads built and for a continuation of the road building program.

Chas. M. Upham, engineer and director of the American Road Builders' Association, presented a plan for stabilizing highway construction, based on the improvement of 100,000 miles of highway improvement per year (which incidentally is more highway building than has ever yet been constructed in one year, yet represents the improvement of only 2% per annum of the 2,500,000 miles of unimproved roads in this country, plus the replacement of existing surfaces, based on an average of 20 years' life of such pavements).

Mr. Upham emphasized the very urgent necessity of coordinated effort on the part of everybody concerned to maintain interest in highway building, in the face of efforts to divert gasoline tax money to other uses and in the face of a general revolt of taxpayers against local taxing authorities. He suggested a return to promotional efforts such as were used eight or ten years ago to bring about public approval and enthusiasm for the construction of specific road projects. He invited the National Crushed Stone Association to join with the American Road Builders Association and seventeen other organizations interested in highway construction in an Advisory Council on Highway Building Stabilization now being formed.

Stabilization of Industry Generally

Dr. Ralph J. Watkins, director of the Bureau of Research, University of Pittsburgh, discussed very comprehensively and interestingly the subject of economical stabilization in general, with particular reference to the part of the trade association in such programs. Summary of his paper follows:

"The proposal of Gerard Swope has brought to the fore in current discussion the place of the trade association in the problem of economic stabilization. The address delivered by Mr. Swope before the National Electrical Manufacturers Association last fall was concerned primarily with a program of insurance protection for employes, including unemployment insurance, but, singularly enough, most of the discussion aroused by that paper has related to the idea of the trade association as an instrumentality of economic control. On this point little is to be found in Mr. Swope's address beyond the general idea that stabilization should be furthered by means of trade associations operating under some form of government supervision. Nothing is said in that paper on the problems of freedom of entry into business, coercion of recalcitrant firms, allocation of markets, determination of production quotas, and price fixing. In consequence, I shall not attempt to discuss the Swope Plan, but shall confine my remarks to a presentation of my conception of the problem of economic stabilization and the relation of economic research to that problem.

"Conviction is growing among business men and economists alike that the battle for "rugged individualism" has been lost because that philosophy is a destructive one in the machine age and no longer

serves the interests of producer or consumer. The growing complexity of our economic system and the increasing extent to which our population is dependent for a livelihood on the orderly conduct of business point to the inevitability of changes in our economic organization directed at more efficient control. The logic of present events suggests, therefore, that a philosophy of control may be essential as a substitute for the out-moded philosophy of unregulated competition.

Business Must Learn to Control Itself

"If economic stabilization is to be achieved under our present form of economic organization, then American business must learn to control itself, subject to that degree of public supervision which experience indicates to be essential. The trade association or industrial institute, representing those with common interests, is the logical organized body for control in each of our industries. Industrial control presents a problem of reconciling viewpoints and interests within the industry and of coordinating activity within the industry and between industries. No agency of business is better equipped to attack the problem than industry's own trade organizations.

"Our attitude toward competition has undergone a complete shift of emphasis within recent years; when our present anti-trust laws were enacted, the public clamor was for protection against the exactions of monopoly. Today we stand in dread of the consequences of unrestrained competition and our need is for protection against instability, economic insecurity, and a low standard of living. We must in some manner achieve regulated competition in the interest of the general welfare.

"It is submitted that what is needed is the establishment of an Institute for Research in Economic Control for continuing scientific investigation of the problems of economic stabilization, including the development of a scheme or technique of organized control of basic American industries with the active collaboration of each organized industry. The program of such a research organization should be shaped to assist in the development of enlightened, cooperative self-control of industry for the purpose of achieving economic stabilization.

Mergers and Central Sales Agencies

Gilbert H. Montague, attorney-at-law, New York City, discussed in a very informal but illuminating way a specific phase of stabilization of industry—namely, "The Legality of Sales Mergers." Mr. Montague drew a very definite distinction between real mergers and general sales agencies in that the United States Supreme Court had definitely passed on the legality of various mergers but that general sales agencies were still in a class which laid them liable to test suits.

In the case of a merger, the percentage of the industry left outside has a very important bearing. There may be a merger of any number of competing companies, provided there is still left outside of the merger active competition. If subsequent developments eliminate this outside competition, it has no particular bearing on the legality of the merger, unless it can be proved that the merged company used illegal efforts to suppress that competition.

Sales agencies can not legally eliminate all competition any more than can a merger.

Yet, Mr. Montague said, that when an industry gets into the straits of the bituminous coal industry, it will take risks in the formation of such a sales agency, and he described in some detail the plans of the National Coal Association for a national sales agency. Such a sales agency is formed as a stock corporation, with the stock issued to the producers on some equitable basis. The producers then enter into a contract with the agency to permit it to do all of its selling over a period of years. The board of directors consists of all of the producers. There is an executive committee and a voting trust to which all the stock is trusted by the producer owners.

MANY FORMS of organizations to stabilize business have been proposed. Certain changes may be expected in economic organization to achieve this end. Mergers, sales agencies, uniform sales contracts, limited sales territories, and other plans are discussed. The result of these proposals may vitally affect every business.

Mr. Montague said it was difficult to get an American business man to thus surrender his independence, but under the straits in which the coal industry is, it apparently can be brought about.

Another possibility of stabilizing competitive conditions, Mr. Montague said, was selling under a more or less uniform sales contract with local associations set up to see that producers lived up to their agreements. Probably, he said, under such an agreement, the assistance of the Federal Trade Commission could be obtained for its enforcement.

In answer to various questions asked from the floor, Mr. Montague made it very clear that there must be a distinction between intrastate and interstate mergers or grouping. In New Jersey, for example, there is no anti-trust legislation. Some of the other states have strict anti-trust laws, and some have liberal ones.

In regard to the absorption of freight rates as a means of unfair competition or price cutting, Mr. Montague believed that it was entirely lawful unless the offending producer's price schedule was violated. In other words, if the freight rate were absorbed in the price to one consumer in a locality, it would have to be absorbed on other shipments to the same destination, all other conditions and circumstances being the same, to prevent discrimination between purchasers.

Regarding the possibilities of legitimately dividing territory, Mr. Montague said that he saw no prospects that this could be done legally, but that some time the United States Supreme Court might recognize selling agencies as on the same basis as mergers. The only possibility he saw of dividing territory would be the universal selling of the product on an f.o.b. mill price basis, which would automatically bring about the restriction or division of territory.

Answering questions as to whether the problem could be narrowed to the volume produced in a certain territory, Mr. Montague said that the courts were interested merely in markets and were not concerned with where the products in those markets came from. Consequently there could be no method of controlling production of the product except through the control of the market.

Asked regarding the right of producers to discuss prices among themselves, Mr. Montague said that this could be done legally only so far as it concerned past transactions. However, it is entirely legitimate for a producer to get out a price list and to mail this to the trade.

Legitimate Trade Practices

Harold Williams, attorney-at-law, Boston, Mass., discussed Mr. Montague's talk, prefacing his remarks by saying that he believed we were a great deal nearer stabilizing our industrial production than most of us now realized. He defined stabilization as a normal working of the law of supply and demand; present troubles are due to abnormalities. His theory was that our present over-production was due to inflation of demand—the only way business men had tried to make up for the growing over-capacity to produce. He made some broad statements that business men were not well posted on economics and had used false methods to meet the issue of over-expansion. What is needed, he said, to accomplish stabilization is to determine demand scientifically. Then a revision is needed of the anti-trust laws.

Even under present laws, Mr. Williams believed that something could be done for stabilization. For instance, there are various elements that enter into the price of a commodity. It might be possible to fix on some one element of price such as profit, and have producers agree to this,

such as on a maximum or minimum margin of profit.

Mr. Williams added that too large profits in the past were among the causes of our present economic condition.

Burton A. Ford, former general manager of the National Lime Association, now of New York City, at the annual meeting of the National Agricultural Limestone Products Association, discussed the trade association as a stabilizer largely from the angle of its possibilities in rubbing off the square corners of individuals and making them more susceptible to suggestion and cooperative efforts.

He said the fundamental object of trade associations was to teach its members economics and teach them not to fight economic conditions; to keep them awake to changes in their industry.

He said that it was the business of trade associations to take more interest in government and to combat the government's tendency to constantly create more and more job holders. He said there were certain things that trade associations can do to help the price situation even under present anti-trust laws. For example, there is nothing in the law that makes it illegal to sell one's product at a profit. All that is needed to bring this about is mutual trust in one another, which a trade association should certainly be very influential in creating.

Government and Business

Hon. James M. Beck, United States Congressman from Pennsylvania, in his after-dinner talk at the association's banquet, spoke on "Government in Business," in which he denounced the extension of government bureaucracy into a thousand-and-one activities that more properly belong to private business enterprise. The rest of his address had to do with the necessity of meeting the present situation of industry by old-fashioned hard work.

Among other things Congressman Beck said, "We have drained the productive wealth of our country to maintain bureaus, and there are over 150 of them, all attempting to regulate the life of private citizens from the cradle to the grave."

Incidentally, he made some rather uncomplimentary remarks about the Eighteenth Amendment and the government bureau entrusted with the enforcement of the prohibition laws. Needless to say, Congressman Beck did not include the Bureau of Mines, nor the Bureau of Standards in his category of useless bureaus, but he did mention a number of others by name which he considered useless.

Inspiration

W. D. Burruss, "inspirational sales counsellor," Washington, D. C., under the title of "Start from Where You Stand," gave a typical inspirational address, in which he stressed the importance of right thinking and the power of optimism as a substitution for pessimism and of confidence for fear as the way to overcome our present economic difficulties.

Dr. H. S. Hulbert, psychiatrist, Chicago, Ill., made an interesting address on "Modern Usages of Ancient and Inherited Mental Tendencies," in which he drew largely from Biblical references to show how human beings arrived at their present mental standards of courage, generosity and sportsmanship, rather than the older ones of faith, hope and charity.

Association Activities

A. L. Worthen, president of the Association, in his annual report and address, reviewed the activities of the Association, emphasizing the necessity of the utmost economy in its management due to present business conditions. One feature of the work of the Association which President Worthen believed it doubtful if the entire membership was using as it might, is the work of the Bureau of Engineering, inaugurated early in 1931 as "Useful Information Service." These are short informative reports designed to supply, in a form that the salesmen of crushed stone companies can absorb readily, vital, helpful technical data on the uses of crushed stone.

Among other things President Worthen stated, "Comprehensive laboratory tests have shown the marked superiority of crushed stone over other aggregates as railroad ballast material, and although the results of this investigation were not published until late in the year, there have already been reported instances of direct benefit to some of our producers as a result of this report."

The work of the Association has been somewhat radically reorganized under President Worthen's administration so that there are now but four standing committees. These are Interpretation Committee—Trade Practice Rules, Transportation Committee, Cost Accounting Committee and Research Advisory Committee. The Research Advisory committee, however, has been divided into numerous sub-committees.

J. R. Boyd, secretary of the Association, reported in considerable detail the various activities of the Association during the year, particularly relating to finances which are in a very favorable condition considering all things.

A. T. Goldbeck, director of the Bureau of Engineering of the Association, reported in detail on his various activities including a long list of publications and his committee activities in various engineering societies which concern themselves with the use of aggregates.

Summarizing his work, Mr. Goldbeck stated: "The greatest benefit of the work of the Bureau to the members of the Association is derived from that portion of the work which is of a basic nature. For it is this sort of work which benefits the industry as a whole. The study of fundamental problems in the laboratory, such as the stability of bituminous materials and the development of a proper soundness test, the development of a method for beam testing and the design of concrete having a given beam strength, the publication of technical information, the development of a size standard, are all projects having general application. It would be highly desirable if we could engage on such projects almost exclusively, but it is recognized that individual problems of producers should also be solved. We are making an effort to properly take care of the individual problems as well as those of general application."

Mr. Goldbeck's report of the work of the laboratory was given in some detail in Rock Products, January 9, 1932, pages 92-93, so we will not repeat it here.

Research Important in Modern Business

Paul B. Reinhold, chairman of the Research Advisory Committee, gave the keynote of the attitude of his committee toward its job in the following: "There seem to have been invented only three ways of running a business. One is by rule—doing what your grandfather did. The second by hunches, that is, getting in on the ground floor—getting something for nothing. The third way of running a business successfully is based on a thorough and consistent campaign of research. Research is no more a 'side-issue.' It is positively essential. Business without research is bound to stand idly by and watch the procession of progress pass. Research is not simply a matter of 'digging for figures and facts,' but is 'digging for dividends.' Every executive and every stockholder is vitally interested in dividends."

Summarizing, Mr. Reinhold said:

"1. If the crushed stone industry proposes to move forward and not backward it must pursue an intelligent program of research.

"2. To follow such necessary activity requires MONEY.

"3. When you are requested to contribute to the research fund you are simply paying a premium to insure future business security and success.

"4. All of the officials of the Association, Mr. Goldbeck, and the members of the Research Advisory Committee are working very hard and diligently with one primal motive, namely, 'digging up dividends' for each and every one of you. Therefore, your absolute maximum personal and financial assistance is justified."

The Research Advisory Committee has worked up a scheme of organization with a

constitution to govern its procedure and obviously is doing a splendid job for the Association and deserves its unanimous support.

Uniform Cost Keeping

William E. Hilliard, chairman of the Committee on Uniform Cost Accounting, reported that a substantial number of forms on quarry costs for 1930 had been filled in and sent to the Washington office and that progress was being made in the adoption of the Association's uniform cost accounting system, but he recognized that it was a matter of long education to get its unanimous adoption. The main purpose of the Association's uniform cost accounting system, which represents a tremendous amount of work on the part of the committee, of J. R. Thoenen of the United States Bureau of Mines, and others who have collaborated, is the benefit that each producer of crushed stone will obtain in his own business. But a secondary purpose and added advantage may lie in the future interchange of cost data among the members when they come to keep their costs on a reasonably uniform basis.

Why Adopt Uniform Cost Accounting System

Mr. Hilliard, in addition to presenting his report as chairman of the Cost Accounting Committee, also presented a paper, "Why Adopt the Association's Uniform Cost Accounting System," abstract of which follows:

"In any manufacturing business, it is of vital importance that the management know the exact cost of the units of production. Without such knowledge, a concern can sell blindly in the open market, obtaining the best prices it can in competition with other firms, and manage perhaps to continue in business for a time; but at any time, and especially in a period of falling prices, such a firm is at a loss to know exactly at what point it can sell at a profit and exactly how much it is losing per unit if it sells below that point.

"In the crushed stone industry, the necessity for analytical cost accounting was not so vital some years ago when the business was being developed; but as time went on, the industry came to the point where the best profit could be made only by obtaining a small margin of profit per ton on as large a tonnage as the plant could produce. It became more essential that each producer should know exactly the quarry cost of his material; and of course should also know the exact cost per ton for administrative and selling expenses. During recent years, as a rule the larger concerns that produced crushed stone have had reasonably good cost accounting systems of their own; and in some cases, particularly fine systems. Many others, however, while they were able to obtain the total cost of operations, and divide by the total production and therefore obtain a cost per ton which was approximately correct, did not have adequate information as to just the amount of each factor of production which went into the final cost figure. Many of the smaller producers even yet proceed more by guesswork than by exact knowledge in estimating their costs.

"The manufacturers in many other industries of a more highly technical nature than the business of crushing stone, learned some time ago of the advantages of uniform cost accounting systems planned especially for such industries. During the last year and a half, a committee of the National Crushed Stone Association planned and made available for the members of the Association, a manual setting forth a uniform cost accounting system. It has been the earnest hope of the committee that this manual be adopted as widely as possible by all producers in this organization.

"This system is an excellent one in itself. Any producer who uses it year after year will have the data with which to compare the details of his operation in different seasons, to present a more complete picture of all his quarry operations, which is impossible without a good cost system.

> ***THE MAIN PURPOSE of the Crushed Stone Association's uniform cost accounting system is to provide direct benefit to each producer who uses it in his own business. It will later make possible the interchange of cost data among the members. Only by knowing the exact cost of the units of production can a producer know exactly at what point he can sell at a profit.***

"One of the benefits anticipated by the use of this system is the elimination of waste of labor.

Cost Keeping Promotes Efficiency

"Fear is too often the impelling motive of the workman—fear of losing his job. To accomplish certain tasks assigned to him, he may be wasteful of his own time and energy in trying to make a good showing on the surface of things. He fears censure, if his work is not satisfactory, and expects no commendation for work well done. A good cost system helps to make it possible for the management to know definitely the results accomplished, not only by different departments, but also by different individuals, and with this knowledge, those in authority are able to commend a foreman or a workman for his accomplishments and create in him a better appreciation of his own ability and a desire to give his employer the best he has in him. Ambition may replace fear as a compelling motive.

"Another benefit may be the elimination of waste of material.

"While occasionally a workman may waste materials or supplies on account of spite or malice, that is of course the rare exception and not the general rule. But enormous waste in coal, oil, electric power, raw materials and supplies is occasioned by carelessness and thoughtlessness on the part of men who merely try to do things the easiest way for themselves. Many of them would at once change their ways and use all supplies and materials more economically if they thought anyone really knew from exact records just how they used them and cared enough to commend them when they tried to use the supplies and materials economically. In some cases, bonuses can be arranged to make it a financial benefit to a workman if he can do better than a certain standard of production or accomplishment which has been set up to aim at. But even when such payments cannot be readily arranged, simple praise for good work is more effective than is commonly realized.

"Still another benefit may be elimination of waste in use of equipment.

When Does New Machinery Pay?

"Machinery has replaced manpower to an amazing degree in quarry operating in recent years. But such machinery, while it helps in reducing cost if properly used can lose much of its advantage if it is not properly used. When there is too little machinery, it can be over-worked and worn-out without obtaining the best results. When there is too much machinery, the excess investment may become a financial burden. Furthermore, machinery naturally tends to become less valuable and effective even when it stands unused; and of course during a few years it is likely to suffer from obsolescence because of the invention of newer and more efficient machinery to do the same kind of work.

"A good cost accounting system will furnish operating data about the machinery which a concern is using. Guided by these data, the management should be able to purchase new machinery for expansion or replacement more intelligently and more in accordance with the real requirements of the concern.

"A system of cost accounting in itself will not, of course, produce any of these results, but it does afford the management a more definite knowledge to use in trying to run the quarry and plant to the best advantage.

Exchange of Cost Data

"Another advantage of a uniform cost accounting system is the possibilities of the exchange of cost data among different firms in the same business. One method is to issue blank forms based on the system in use, to be filled in and returned to a central bureau or association office. Code numbers are placed on each form when the blank forms are sent out originally by the central bureau. When the forms have been filled in by the individual concerns and returned to the central bureau, the name of the individual firm does not appear on the report. That report may be used for comparison with many others, but the identity of the firm is not disclosed. The method of using code numbers helps to overcome the reluctance which cer-

tain managers might naturally otherwise have in revealing their own private cost figures.

"Under this method, one manufacturer may compare his own cost analysis with a group of these other reports item by item and learn that while the cost of the different operations in his quarry seem to be pretty much in line with those of the rest of the group, some one item such as Haulage from the quarry to the mill might be considerably higher per ton in his figures than in the figures of the other concerns; whoever they may be.

"He is interested to look into that one process in his quarry exhaustively. It may be that owing to some unusual features in the layout of his quarry, his haulage costs naturally have to be greater. On the other hand, he may find that he has not kept his hauling equipment or methods up-to-date and that other quarries are benefiting by more economical methods or equipment, which he too can install and adapt to his own financial advantage. Once again it is clear that a uniform cost accounting system will not necessarily produce this result for him of itself. But it will afford him comparative information which he could not obtain otherwise. By acting on this information, he may have the oportunity to improve the operation of his quarry.

"One very important possible future advantage may result if this system is quite widely used throughout our industry. The federal laws governing interstate commerce and the laws of practically all of the states for governing business within their own borders are based on the principle of free and unlimited competition. As you know, efforts have been made in the past and more determined efforts are to be made in the near future to have some modification effected in the laws regarding restraint of trade. Preliminary drafts of proposed bills in Congress designed to let trade groups regulate competition to some extent indicate the following measures:

"1. To reorganize the Federal Trade Commission.
"2. To give more definite status in law to trade conference procedure by trade associations under the regulation of the Federal Trade Commission.
"3. To provide in the law that certain kinds of agreements by trade groups shall be lawful.

"We are especially interested in this last proposal, namely, to provide in the law that certain kinds of agreements by trade groups shall be lawful.

Proposed Lawful Agreements

"Here are some typical examples of proposed lawful agreements:

"*A.* To make agreements to adopt uniform terms of sale in reference to discounts, credit terms, delivery charges, advertising allowances, premiums, prizes and the like.
"*B.* To make agreements to gather and distribute all kinds of statistics in the trade beyond what is already legal.
"*C.* Most important of all, to make agreements to refrain from selling below the cost of the individual seller.

"If this last measure should become legal in the near future, it would become necessary for any group of business men such as stone producers to have some comparable basis of finding their costs of production. If a uniform Cost Accounting System were already in use quite generally throughout an industry and such legislation as suggested should become effective, that industry would be in a position to benefit almost immediately from the new laws. Without a Uniform Cost Accounting System, that industry would find it necessary to develop one and get it quite generally used in order to get the most benefit from the new laws; and it would take a long time to get a system ready and then get it established in general use.

To sum up the salient points of what we have been saying, we have the following reasons for adopting our uniform cost accounting system:

IT IS NOT IMPOSSIBLE that legislation permitting the regulation of competition by trade groups may be enacted. Should this occur it would become necessary for any group of business men to have some comparable basis of finding their costs of production. Any industry which has quite generally adopted a uniform cost accounting system would be in a position to benefit almost immediately from such new legislation.

"1. Because being a good system in itself, it will furnish valuable comparative data from year to year or month to month in a producer's own business.
"2. Because it can be used to help eliminate waste of labor.
"3. Because it can be used to help eliminate waste of material.
"4. Because it can be used to help eliminate waste of equipment.
"5. Because it may be used in comparison with the results obtained by other producers who use the same method to the mutual advantage of all concerned.
"6. Because if such a system is already in operation in an industry, it may enable the operators in that industry to benefit more promptly and more completely from possible future modifications of our present laws regarding restraint of trade.

"If I had the logic of Plato, the eloquence of Demosthenes, the scintillating humor of Chauncey Depew and the ready wit of Will Rogers, I would employ them all in my appeal to the members of this Association to adopt our uniform cost accounting system, for their own individual benefit and for the benefit of all, who are connected with this nation-wide industry.

Postscript on Proposed Legislation

"I have just learned that there was presented in Congress only last week by Mr. Lewis, House of Representatives Bill No. 7448 entitled, "A bill giving the protection of the law to the workers' right to work and guaranteeing him an equal share of the employment available; forming trade associations for industries and their employes doing an interstate business, in order to enable such industries to *stabilize business* and to provide certain benefits for employes, to wit:

"*a.* Life and disability insurance.
"*b.* Workmen's accident compensation.
"*c.* Workmen's pensions.
"*d.* Unemployment insurance; and imposing certain excise taxes.

"Section 9 states that 'The Federal Trade Commission is authorized and *directed* to cause the corporations subject to this act, designated and classified by it under section 8 of this act and engaged in each such trade to form a national trade association and to give distinctive names to each such association.

"Section 6 covers stabilization of production and reads as follows: 'Plans for the stabilization of production shall include:

"'1. Use of standardized accounting forms, *standard cost system,* balance sheet and earnings statement, which shall be prescribed by each national trade association, subject to supervision and approval of the Federal Trade Commission.'

"There are six other items, covering exchange of data, annual statements, income tax statements, reports of member corporations to the trade associations about payrolls and working hours, and a standard accident compensation system. But please notice that before anything else is specified, in article number 1 a standard cost system for each industry is definitely demanded.

"On the one hand, this bill presumably will not become a law at this time, containing as it does such a complete reversal of principles from our previous laws. On the other hand, it is very likely that some of the principles embodied in this bill may become enacted laws in the future."

Sample of Comparative Cost Data

A sample of the Association's cost keeping method which may be applied in a very simple form (A), or more elaborate form (B) or still more elaborate form (C) is given in the accompanying tabulation which represents the actual operating cost of a fairly large operation.

FORM "A"
Costs for Small Quarries

	Cost per ton of stone produced
Quarry	$ .3044
Plant	.1495
Storage	.0432
Delivery (shipping)	.0330
Total cost per ton of stone produced	$ .5301

Production—641,608 tons
Shipments—637,973 tons

FORM "B"
Costs for Medium to Small Quarries

Quarry	
Stripping	$ .0184
Drilling	.0458
Blasting	.0372
Loading	.0823
Hauling	.0608
Miscellaneous	.0499
Depletion	.0100
Total quarry cost per ton of stone produced	$ .3044

Plant		
Crushing	$	
Screening	$	
Conveying	$	
Total plant cost per ton of stone produced		$ .1495
Storage		
Into	$	
Out of	$	
Total storage cost per ton of stone produced		$ .0432
Delivery (Shipping)		.0330
Total cost per ton of stone produced		$ .5301
Production—641,608 tons		
Shipments—637,973 tons		

FORM "C"

Detailed Costs for Medium to Large Quarries

Quarry	Stripping	Drilling	Blasting	Loading	Hauling	Miscl.	Depletion	Total
Operating Labor	$ .0125	$ .0216	$ .0055	$ .0363	$ .0140	$ .0285	$	$ .1184
Operating Material	.0004	.0114	.0295	.0081	.0078	.0021	.....	.0593
Repair Labor	.0003	.0014	.....	.0159	.0091	.0017	.....	.0284
Repair Material	.0003	.0017	.....	.0103	.0056	.0016	.....	.0195
Power	.0032	.0053	.....	.0019	.0021	.....	.....	.0125
Sundry Expense	.....	.....	.....	.....	.....	.0111	.....	.0111
Overhead	.0011	.0020	.0022	.0048	.0035	.0035	.....	.0172
Charges from Reserves	.0006	.0007	.....	.0050	.0006	.0013	.....	.0082
Special Charges	.....	.0017	.....	.....	.0181	.....	.....	.0198
Depletion	.....	.....	.....	.....	.....	.....	.0100	.0100
Total Quarry Cost Per Ton	$ .0184	$ .0458	$ .0372	$ .0823	$ .0608	$ .0499	$ .0100	$ .3044

Plant	Crushing and Screening and Conveying	Total
Operating Labor	.....	$ .0241
Operating Material	.....	.0064
Repair Labor	.....	.0132
Repair Material	.....	.0257
Power	.....	.0270
Sundry Expense	.....	.0054
Overhead	.....	.0058
Charges from Reserves	.....	.0295
Special Charges	.....	.0124
Total Plant Cost per Ton	.....	$ .1495
Total quarry cost per ton stone	$ .3044	
Total plant cost per ton stone	$ .1495	

Storage	Into and Out of	
Operating Material	.0022	
Repair Labor	.0033	
Repair Material	.0031	
Power	.....	
Sundry Expense	.0070	
Overhead	.0022	
Charges from Reserves	.0132	
Special Charges	.....	
Total Storage Cost per Ton of Stone	$ .0432	.0432
Delivery (Shipping)		
Operating Labor	$ .0172	
Operating Material	.0008	
Repair Labor	.0013	
Repair Material	.0013	
Power	.0022	
Sundry Expense	.0002	
Overhead	.0028	
Charges from Reserves	.0072	
Special Charges	.....	
Total Delivery Cost per Ton of Stone	$ .0330	.0330
Summation of items quarry, plant, storage and delivery should give total cost per ton of stone produced		.5301
Production—641,608 tons		
Shipments—637,973 tons		

W. R. Sanborn, chairman of the Association's Transportation Committee, reported in part: "The outstanding job of this committee for the year was in connection with Ex Parte 103, wherein railroads endeavored to secure an increase of 15% in all freight rates. The committee made a most careful analysis of the situation from all standpoints and presented its case to the Interstate Commerce Commission. Apparently we had some influence with the Commission's final determination. One recommendation of this committee in the presentation of the case was that if the Commission felt that an increase must be made, that if the increase were only nominal such as 5c. per ton, we would favor a flat increase of that amount rather than a 15% increase. It will be noted that the final order of the Commission provides an increase of 6c. per ton on stone, sand, gravel, slag and numerous commodities. This increase may be burdensome in spots, but on the whole, considering all the conditions, we feel that the industry will probably be able to contribute this much to the general good of the country."

John Rice, Jr. (General Crushed Stone Co., Easton, Penn.), told what has been accomplished in the way of the adoption of a uniform sales contract. Mr. Rice gave in detail the form adopted by the Pennsylvania and New York State Crushed Stone associations and used by his own company.

ARE crushed stone producers lax in handling sales? "Too many of them in the past have not used contracts," states John Rice, Jr. "No large concern would countenance the careless basis on which orders for stone are accepted," he says. To correct this a uniform sales contract is recommended. Such contracts should be drawn for each particular territory where existing laws are the same.

He said in part: "It might not be amiss to discuss at this time the laxness with which crushed stone producers have handled their sales. Too many of them in the past have not used contracts. It is true that many have had order forms on which sales were registered, but in most cases the buyer was not even required to sign these forms. Many contracts which have been used, and which are still in use by certain producers, contain terms that would not be legally accepted and afford neither themselves nor the buyers adequate protection. Verbal orders, involving thousands of tons of stone, have been sold by crushed stone producers who trusted entirely to luck that the buyer would be successful in his work. Many of you here today do not fully appreciate the laxness with which many stone producers are carrying on their sales. No large or well known concern today would countenance the careless basis on which orders for stone are accepted by crushed stone producers.

"It is evident, therefore, that there is an urgent need for producers to get together and adopt a proper form of uniform sales contract in the handling of their sales. The question may arise as to what is a good uniform sales contract and in reply, I would answer that it is one that is agreeable to all of the producers in a particular locality, legal in respect to the existing statutes, fair in respect to its demands on the buyer, and sincere in its guarantee to perform satisfactory service and supply material that will adequately meet specifications. It cannot be one-sided, for it must afford adequate protection to both the buyer and seller in order to be successful.

"There are naturally a number of different forms of sales contracts that are both protective and acceptable. Uniform sales contracts must in some cases differ because of different statutes existing in different territories. Uniform sales contracts, therefore, should be drawn for each particular territory or district where the existing laws are the same.

"Now, as to the advantages of the uniform sales contract:

"1. All buyers in a particular territory are subject to the identical terms of sale. This eliminates buyers quibbling about terms of payment, discounts, rebates, and other unfair demands. After the buyer becomes accustomed to using the uniform sales contract, he considers this as a standard or a guide and insists that other contracts cover the same terms as the uniform contract in use in his territory.

"2. The uniform sales contract aids in stabilizing prices for stone in a particular locality, since the terms in the contract have been agreed to by the producers in the locality. Often the existing prices are sooner or later upset because one or more producers continue to either extend the terms for payment or offer excessive discounts for cash or prompt payment. This is merely a form of price cutting, which eventually destroys the price structure in any market.

"3. A uniform sales contract is unquestionably better drawn and better constructed from the standpoint of protection than would be the case if left to the experience of an individual firm, as it consolidates the experiences of all the operators in a particular district. An individual firm may fail to protect itself on several terms, which is not so apt to be the case if it is drawn up by a group of firms.

"4. A uniform sales contract forces the buyer to cover his purchases by a contract, since all buyers in a particular locality are requested by all producers to sign it. The buyers soon become reconciled to the situation and eventually like the idea of having all of the conditions and terms of sale written out in a clear-cut fashion. The reason many stone producers at the present time hesitate to use any form of contract is be-

cause of the buyer's resistance to sign it. It is naturally his preference to do business with a producer that will be lenient in the terms of the sale."

Pennsylvania Producer's Successful Experience

Ellwood Gilbert, discussing the successful experience of the Pennsylvania Stone Producers with a uniform sales contract, said in part: "Even though the producer may hesitate to adopt a form of sales contract on account of the sales resistance it may set up, he finds after it has become generally used and its provisions are familiar to both himself and the buyers, that both parties come to welcome it as an instrument on which to lean for service and protection.

"I should like to be permitted to draw the inference from this statement that a uniform sales contract establishes a common ground upon which your sales representative meets the potential buyer. Under these conditions, confidence and respect are established in the mind of the buyer and your salesman is possessed of new born courage; mainly so because he knows that the material and service and terms and price are being offered to the buyer under the same conditions as he may hope to receive from your competitor.

"Oftentimes it so happens, where a sales contract is not being used, that there is doubt in your salesman's mind as to just what is being offered the buyer in return for his business. Repeat sales to a friendly consumer are lost with the argument ringing in your ears that better terms and prices are being offered. Oftentimes, after repeated calls on a customer, our confidence in our competitor is broken, even though unjustly, and the business is taken at a big disadvantage to ourselves. Distrust has been established in the mind of your competitor and future sales on a profitable basis become even harder to secure.

"From the viewpoint of a salesman, I like to be mindful always of this fact when approaching a prospective buyer: that the true measure of a man cannot be had by approaching him from the front, but rather must we get back of him and stand in his tracks, and looking through his eyes, get the same perspective. I am firmly convinced that the use of a uniform sales contract by any group of producers makes it possible for the buyer and the salesman to stand shoulder to shoulder on common ground and each looking in the same direction, through the same eyes, get but one perspective, and with this mutual understanding and confidence established between them, they both are benefited and go forward to better things and greater opportunities."

A. S. Owens said: "I would like to emphasize the point that you only have to sell a man on the sales contract once. After you have sold him on this sales contract the first time, he then knows about it, and in future transactions takes its use for granted. When you consider that you do not have to sell the use of the contract every time, I think that will help a lot in having a uniform sales contract adopted."

The adoption of a uniform sales contract by the National Association was recommended.

Specifications and Research

P. J. Freeman, chief engineer, Bureau of Tests and Specifications, County of Allegheny, Pittsburgh, Penn., discussed "Effect of Coarse Aggregate on the Durability of Concrete." Extracts of Mr. Freeman's address which was well illustrated by lantern slides follows: "It is my belief that the year 1932 will be a hard year for the aggregate producer. The lull in construction activities has given the material engineers time to do a lot of research and think up some more specification requirements for aggregates. Every technical publication which you pick up has something in it for you folks to worry about.

"The American Society for Testing Materials and the American Concrete Institute have committees which are studying the durability of concrete as affected by the aggregates. These studies are directed towards the ability of the aggregate itself to resist the disintegrating forces of nature and the volume changes which may affect the durability of the concrete.

"Undoubtedly such research is very important and in the end it will promote the production of better concrete, but in the meantime you producers must be on the lookout for trouble. A certain amount of concrete has deteriorated on account of unsound or unsuitable aggregate, but in the past these failures were usually blamed on the cement or the contractors. Conditions have changed so that each material must stand on its own merit and facts only are to govern such investigations of concrete failure.

"The work of the various committees is being published, and I am afraid that some engineers will be inclined to take theories for facts and assume that the reports of tests made on certain materials can be applied to materials in general and that there will be a large amount of aggregate classed as 'unsound,' which would be quite suitable for making concrete.

"The members of the National Crushed Stone Association fortunately have anticipated this situation by establishing a testing laboratory under the direction of an engineer whose technical standing as a testing engineer is of the highest rank and whose knowledge of the subject of durability of aggregates places him so nearly at the top that I would not know where else to classify him.

"When your troubles come, you can pass them on to Mr. Goldbeck and let him do the work provided your materials are actually durable and suitable for use in concrete. If your stone is unsound and lacks durability then it should be sold for use in low cost roads and not for concrete pavement or structures.

Proportions of Concrete Mix Affect Durability of Aggregate

"The durability of concrete is affected by the amount of cement used in the mixture and in general the commonest of disintegration is lack of cement combined with bad construction practice. In some cases by the use of richer mortars it is possible to produce a durable concrete with a coarse aggregate which if used in leaner mixes would produce a concrete which would disintegrate. This is a subject which should be more fully investigated in the laboratory and information made available in connection with aggregates from various sources and it is my belief that the laboratory of the National Crushed Stone Association should do work on an extensive scale and endeavor to determine the minimum amount of cement which will render such aggregates suitable for concrete.

"There are, however, some coarse aggregates which will produce unsound concrete regardless of the richness of the mixture and these are never suitable for use in concrete. It is rather difficult to isolate such examples but there are some instances where the knowledge of all of the factors involved is complete and the disintegration of the concrete can be definitely traced to the unsound coarse aggregate."

According to Mr. Freeman, the sodium sulphate test is the best test known at present for the determination of soundness, and the degree of absorption is no index of the unsoundness of the material. He stated that five treatments or cycles of this test would in general indicate that the concrete will be durable. His talk was illustrated by lantern slides showing some outstanding examples of poor concrete made from inferior limestone in Pennsylvania, contrasted with good concrete, and where the ingredients and conditions were the same in every way except as to the coarse aggregate used. The quarries from which such inferior rock was taken were also shown and the effects of weathering on the ledges.

Trends in Specifications

H. S. Mattimore, engineer of tests and materials investigation, Pennsylvania Department of Highways, Harrisburg, Penn., described the trend of specifications of crushed stone. Mr. Mattimore said in

part: "To realize the trend of crushed stone and other material specifications, if a comparison is made with the present specifications on these materials and specifications enforced several years ago, it would be readily seen that the present specifications are more definite in containing explicit terms rather than general clauses in vogue for many years. For example, it formerly was the practice in specifications for crushed stone to call for aggregates clean, sound, and free from any deleterious materials. The change in the modern practice is to definitely limit the per cent of deleterious material, and in case of the term for cleanliness an endeavor is made to state this in the amount of coating permissible on the stone particles.

"DURABILITY—One of the desirable features essential in all construction is to use a material of durable nature. Attempts are being made at the present date to definitely specify test requirements for durability of aggregates. I refer to sodium sulphate accelerated soundness tests, and the freezing and thawing tests. All constructors realize that structures exposed to the elements in northern climates, must resist freezing and thawing, and have concluded that the materials entering into different structures must be of a nature to also resist these stresses. This subject of soundness and freezing and thawing tests has been well described, and my purpose in discussing them is to indicate the tendency of specification writers to adopt this as a test for the selection of durable aggregates.

"CLEANLINESS—It has been the practice for a number of years to specify that all concrete aggregates shall be clean and free from coating, and no details were given prior to the past several years relative to just what this indefinite clause meant, and how it should be determined if an aggregate met such requirements. The present tendency is to definitely state the kind and percentage of coating and deleterious material permissible in crushed stone or other aggregates. For instance, one specification adopted by a national society states as follows:

The maximum percentage of deleterious substances shall not exceed the following values:

	Per cent. by weight
Removed by decantation	1.0
Shale	1.0
Coal	1.0
Clay lumps	0.25
Soft fragments	5.0
Other local deleterious substances	....
Total clay lumps and soft fragments	5.0

(It is recognized that under certain conditions percentage of deleterious substances less than shown in the table, should be specified as the maximum.)

"I quote this specification in detail to demonstrate the present tendency in specifications to develop definite requirements that are determinable by tests instead of general terms as formerly used.

"Such definite clauses in specifications are advantageous to all parties concerned. I would consider that they are especially desirable to the producer, as it eliminates rejections based on what may be personal judgment rather than definite determinations. I believe at the present day there is no justified objection to limiting the amount of deleterious material in a crushed stone which would be used in concrete work. There may be some objections to the specific limits placed in some specifications, but this may be a problem of geographic location, in that, in some sections crushed stone and other aggregates can be quarried and prepared free of all deleterious substance, while in other locations their removal may require costly preparation.

"GRADATION—In concrete aggregates there is a growing tendency to call for shipment in separate sizes. There is no doubt that this is a forward movement.

WITH increased knowledge of concrete developed through research, specifications are becoming more exacting. These specifications encourage scientific control in the production of aggregates, and a full knowledge of this trend and its influence on consumer demand is vitally important to every producer of crushed stone who is looking to the future of his business.

It reduces segregation and gives a better opportunity to meet the requirements of designed mixes. When this practice was started first some engineers required that stone, when used as a concrete aggregate, should be delivered in three separate sizes, but I believe the present tendency is to reduce this to two sizes. In the spread of gradation of stone used in concrete aggregate, the delivery of three different sizes is an unnecessary requirement. It also might be a hardship on the contractor requiring extra equipment, additional stocking space, and increase on the length of railroad sidings.

"Any change of this type in the specification is an additional expense to the contractor in regard to equipment requirements. Therefore if such a move is made I believe sufficient notice should be given to the contractor so that he can prepare for it in the equipment requirements.

"There was a tendency within the past several years to increase the amount of crushed stone aggregate in concrete mixes. This increase was usually in the small sizes. The reason for its adoption was economy in saving on the cement content. Some engineers were led to believe that this was a dangerous procedure from the standpoint of durability. The Bureau of Public Roads constructed a pavement in the vicinity of Arlington, Va., for the purpose of determining the practicability of different designs in concrete mixes, one of the problems being to obtain the effect of an increase in the amount of coarse aggregate added. Among the many conclusions formulated as a result of tests on this road, is the following by F. H. Jackson, senior engineer of tests of the Bureau: 'The workability and uniformity in strength of the concrete was decreased in proportion to the amount of coarse aggregate added.'*

"In regard to economy obtained in the reduction of cement content, there is a great danger of such being secured at the sacrifice of durability. In this regard, I will refer you to a report delivered at the December, 1931, meeting of the Highway Research Board, titled 'The Durability in Concrete as Affected by the Water Cement Ratio.'

"STANDARDIZATION OF SIZES OF AGGREGATES—I believe your technical division, along with some other associations started some good work on standardization of sizes. There is always a possibility of standardizing aggregate sizes throughout the United States, but the essential thing to be accomplished at this time is to reduce the number of sizes produced by the larger companies shipping to several states or different communities. In fact this standardization of sizes is a problem of vital interest to the producer. The production of many size coarse aggregates is especially severe to producing plants that ship into several states or different communities requiring different size aggregates for the same purpose. It is a good forward move from that standpoint, and should eventually lead to economy to the consumer.

"STANDARDIZATION OF LABORATORY SCREEN OPENINGS—Attempts have been made for many years to standardize the shape of testing screen openings. I refer to the fact that some laboratories use the round openings while others use the square openings in their testing screens. If this problem had been approached in the early stage of testing, little or no difficulty would have been experienced in standardizing the shape of openings, but the big obstacle to it at the present time is that there is much data established on both shapes of screen openings, and the users of each shape opening thinks that there is considerable more to lose in not being able to refer accurately to this past data than there would be to be gained by the adoption of standard shape openings. Also some organizations have a large number of testing screens in service at the present time, and such a change would be expensive to them. Taking this all into account I believe this is a larger problem than the standardization of sizes, and frankly I cannot conceive of it being a major problem at this time.

"BITUMINOUS ROAD CONSTRUC-

**Public Roads*, Vol. 12, No. 6, August, 1931, p. 180.

TION—Up to this time the specifications were discussed relating to concrete road construction, but, as you know, there is a large amount of crushed stone being used at the present day in the macadam road construction. The present tendency for specifications on macadam and bituminous roads is regulated to a large extent by the importance and cost of the road surface. In penetration and surface treated macadam roads, the quality of stone is of considerable importance. In traffic bound and low cost roads the quality of stone is of some importance, but not to the extent of that material used in the higher type macadam construction.

"Low cost road surface to fulfill the requirement should be constructed with low cost aggregates. This does not necessarily mean so much of a reduction in quality as a reduction in refinement relative to grading requirements.

"TRAFFIC BOUND ROAD SURFACES—A crushed stone aggregate of maximum size of 1¼-in. to 1½-in., containing 15 to 20% of the dust of fracture, has given excellent success in traffic bound courses.

Also a crushed stone aggregate with the 3-in. to 4-in. maximum size and 1¼-in. minimum size, had produced some excellent base course construction, and as the same base is filled with the 1¼-in. maximum size stone containing from 10 to 20% of the dust of fracture, it gives an opportunity to use run of crusher from a maximum size of from 3-in. to 4-in. No special intermediate grade is required on this base stone.

"LOW COST BITUMINOUS SURFACING—In the low cost bituminous surfacing, such as oilbound, retread, and mixed in place, maximum size stone of 1¼-in. to 1½-in., with a minimum size of ⅜-in. free from dust, has given excellent results. This material requires some refinement in gradation, from the standpoint of getting the proper penetration of the bituminous material, and then securing stability into the course.

"It is difficult to obtain standardization in bituminous courses when different kinds of bituminous materials are used as binders. Emulsions and tars require an excess of fines to avoid excess of penetration, while the asphalts require a more open mix in order to secure the proper penetration. This has not always been given due consideration in the writing of specifications. The present trend is for the engineer to take cognizance of this, and to specify the material giving consideration to the kind of bituminous material to be used."

Research Helps Sales

A. T. Goldbeck in his talk at the session of the convention devoted largely to sales under the subject heading—"Do You Know" emphasized the importance to salesmen of a thorough knowledge of the product and its uses. He gave a summary of the characteristics of crushed stone and its advantages as compared with other materials used in making concrete. Among other things he stated that tests had proven that concrete made of crushed stone to be more workable than that made of small sized gravel and that the expansion and any consequent shrinkage and cracking was much less than that made of lightweight slags. He also mentioned the new building code of the U. S. Department of Commerce which permits a less thickness for fireproofing concrete in which stone is used as an aggregate. Mr. Goldbeck also stated that dust on crushed stone used as an aggregate had very little effect on the strength of concrete and that flat and elongated pieces of stone were not as harmful as poor gradation. Stone sand has been used successfully as a fine aggregate, and it also requires proper gradation and should be as coarse as possible in order to obtain good workability. As an example of the proper grading he gave the following table:

AMOUNTS OF CEMENT USED PER CU. FT.

Sieve sizes		4½ bags	6 bags
Passing	4-mesh	100%	100%
Passing	8-mesh	85	80
Passing	16-mesh	70	60
Passing	30-mesh	52	40
Passing	50-mesh	27	20
Passing	100-mesh	5	3
Fineness modulus		2.6	3.0

Mr. Goldbeck warned against the danger of furnishing unsound stone and stated that five cycles of the sodium sulphate test is sufficient to prove the soundness of the material. He also showed the method of calculating the yield of concrete and the number of sacks of cement required per cu. ft. of concrete and the required quantities of fine and coarse aggregate.

Dr. George D. Beal, assistant director, Mellon Institute, University of Pittsburgh, Pittsburgh, Penn., discussed the general subject of research and what it has done for other industries, and while little of this paper had any bearing on the crushed stone industry it was helpful in visualizing the value of research.

Washing and Cleaning Crushed Stone

The larger part of one afternoon's session, was devoted to washing and cleaning stone, under the chairmanship of W. W. Duff, New Castle Lime and Stone Co., New Castle, Penn.

The subject was introduced by A. T. Goldbeck who said in part: "The material eliminated from stone by the cleaning process will be either stone dust or, in some cases, clay or dirt from the quarry. I don't think anybody will object to my saying that clay coating on stone is certainly deleterious and certainly shouldn't occur.

"There seems to be some question, however, as to just how harmful stone dust actually is. Some engineers, however, have built concrete highways and they have found that there seems to be evidence of a lack of bond between the mortar and the stone. They have claimed that in those cases, the stone has been rather heavily coated with stone dust. Other engineers claim that the presence of excessive dust in stone for use in concrete aggregate is harmful, especially in concrete highways, primarily because that stone dust is apt to go to the surface and result in a weak surface layer and that layer in time, under the action of traffic and under the action of frost, will scale off.

"I must say I have never seen any real evidence that those statements are correct. As a matter of fact, you will find some specifications require the addition of certain non-cementitious materials to concrete to promote workability, such as hydrated lime and Celite, materials actually required for that purpose."

Mr. Goldbeck spoke of the things to be considered in the preparation of clean stone. He stated that the trend of all specifications was toward cleaner stone but that he believed they should state the exact results desired rather than simply stating that the stone should be washed. Stone dust is harmful in bituminous mixes in that the coating of dust prevents a good bond. Therefore use to which the stone is to be put largely determines whether it should be washed. When contemplating the washing of stone the water supply and disposal of waste must be considered, and this method of cleaning stone has various advantages and disadvantages which should be taken into account. Washing no doubt reduces sales resistance in many cases. It also permits the making of stone sand as a by-product. On the other hand it adds to the operating cost and complicates the operation. The marketing conditions and requirements and also the physical condition of the stone have of course a great deal to do with the correct answer to the problem of whether to wash or not to wash.

Harry H. Brandon, C. C. Beam, Inc., Melvin, Ohio, described the washing

methods used at this company's plant. Here the overburden is completely removed and there are no seams or deleterious material so that it is simply a matter of removing the stone dust. This is done by means of water jets above vibrating screens.

The stone is crushed, scalped and recrushed dry and then elevated to two sets of three double-decked screens in tandem. These are arranged so that the larger sizes are taken off first, beginning with a 1-in. by 1½-in. size and down to a ⅛-in. by ¼-in. size. The fine material goes to two sand drags in series and all sizes fall directly to the loading bins which have a capacity of about 50 tons each.

Three Sets of Jets Wash Stone at Screen

Each screen is arranged with three sets of jets delivering water at about 40-lb. pressure. The two upper sets are to give volume of water and the lower set is directed at an angle against the flow of stone so that the pieces of stone are turned over and over. About 16 to 18 in. of the lower part of the screen serves to drain off the excess water.

In this way a very good job of washing is done and Mr. Brandon considers that this is due largely to two features of the installation: the use of a surge bin which maintains a uniform stream of material on the screen; and the use of plenty of water. Approximately 500 gal. of water are used per ton of stone.

Another method of cleaning stone was described in a short paper by **F. W. Schmidt,** Jr., of the North Jersey Quarry Co., Morristown, N. J. Here the recrushed stone is dry cleaned by using a fan and collector with a series of pipes leading from all the dust producing points such as crushers and screens. Mr. Schmidt considered this to be equal to the wet process and to cost about the same.

During the discussion which followed these papers the opinion was expressed that in the case of clay the important thing is to keep it out of the stone going to the plant so far as it is possible to do so. **Max A. Altgelt,** vice-president, Servtex Materials Co., New Braunfels, Tex., told of some of the trouble he has experienced on account of red clay balls and the difficulty of removing them. He is now studying ways and means of overcoming this.

One method of doing this, which was described in the discussion as being superior to the use of blades or flights, is the use of loops of chains fastened to the inside of a drum type scrubber. In addition to rotary scrubbers with inside blades, a type of rotary scrubber having tapered screen sections and steel balls is also used for the washing of material containing clay.

Another difficulty encountered in the washing of stone is the formation of mud streaks in the loading bins when the material lays in the bins any length of time, because of the dirty water running down in the bins. **Russell Rarey,** Marble Cliff Quarries Co., Columbus, Ohio, showed how this had been overcome by adding a rinsing chute between the bin and the car.

Another opinion expressed was that in the washing of stone, vibrating screens are excellent for sizes below 1 in. but are not so good for sizes above that.

Crushed Stone Sand

L. M. Dow, designing engineer and supervising engineer, Knoxville, Tenn., described in considerable detail the use of a dolomite sand as a fine aggregate for the construction of the $1,500,000 Henley street concrete arch bridge, Knoxville, Tenn. A brief abstract of Mr. Dow's paper follows:

"The contractors sub-let the concrete to the Ready Mixed Concrete Co., of Knoxville. It was proposed to mix all the concrete at the central mixing plant, located about three miles from the bridge site, and to haul the ready mixed concrete in 13 Blaw-Knox agitator trucks. It was also proposed to use products of the American Limestone Co. for the fine and coarse aggregates. At this point, it might be well to state that Knoxville, being located on the Tennessee river, is well supplied with sand and gravel plants which furnish a high grade of crushed river gravel and washed sand. These river products had passed all specifications throughout the state and had been used extensively in all types of construction. The Holston Quarry Co.'s crushed limestone, to be furnished by the American Limestone Co., was also a familiar material and acceptable for the work. This company also wished to furnish the fine aggregate, and proposed to use its dolomite rock-sand, a byproduct of the American Zinc Co., Mascot, Tenn.

"This sand had never been used on a major project and was practically unknown in the construction field. It had passed the state's specifications for highways and had been given an experimental test on some paving work. However, the state would not allow it to be used on any of its structures. The reason for this was on account of certain conditions of disintegration which had developed on bridges and other structures in Nashville, where limestone had been used for the fine aggregate. All kinds of rumors were out, even to the fact that the 'Mascot' sand had been used on these very structures. This was later disproved, as was also a case in Knoxville, that is the Asylum Ave. viaduct handrails, where it was said the 'Mascot' sand had been used. These handrails had crumbled completely and had to be replaced. Investigation showed this to be caused either by too much limestone dust or too little cement. In all probability, an excessive amount of limestone dust, with perhaps some free lime present, weakened the cement paste from the beginning. Had compression tests been taken on this concrete at the time it was poured, it surely must have shown very poor strength.

A Specification

Specifications called for the usual qualifications of sand, with the following special requirements:

Passing the ⅜-in. mesh sieve	100%
Passing the 4-in. mesh sieve, not less than	85%
Loss by elutriation, not over	3%
Fineness modulus, 2.4 to 3.8.	

"Our own sieve analysis tests of the dolomite met with these specifications. We decided, however, to obtain samples of both the Tennessee river sand and the dolomite sand and have comparative tests made of these two materials by some responsible laboratories. The Pittsburgh Testing Laboratories and Froehling & Robertson, Inc., were selected to make the tests and were furnished representative samples of the two materials.

"The Pittsburgh Laboratories' tests were mostly chemical and compared favorably with the chemical tests which we already had, made by the Nichols Laboratories at Knoxville; and also compared favorably with the chemical tests furnished us by the American Limestone Co., made in their own laboratories and covering a three months' period of time. The conclusion of the Pittsburgh Testing Laboratories was as follows: 'From the chemical analysis of the dolomitic sand, we see no reason to fear decomposition or other deterioration with age, when it is incorporated as fine aggregate in concrete.' They suggested a slight change in the grading by adding to the smaller sizes, and also approved the Tennessee river sand should we desire to use the same.

"The Froehling & Robertson's tests covered the physical features of the two materials (as herein outlined):

	Dolomite sand	Tennessee River sand	
Fineness modulus	2.9	2.5	
Elutriation	0.65%	2.0%	
Tensile strengths 1-3 Mortar briquettes			
Strength ratio to standard of	10.3%	water:	
7 days	125.4%	100.67%	
28 days	126.5%	100.73%	
Compressive strength 1-3 Mortar, 2x4-in. cylinders			
Water-cement ratio, 0.80	4235 lb.	3328 lb.	907
Water-cement ratio, 0.993	3387 lb.	2697 lb.	690
Water-cement ratio, 1.0	2621 lb.	2607 lb.	14

"From the above, you will note the

dolomitic sand proved the better in every instance.

"Following a geological study came the results of the sodium sulphate soundness tests and reassured us that the geological judgment was sound. The dolomitic sand having a water cement ratio of 0.933, with compressive strength at 28 days of 3387 lb., showed 16 cycles to obtain complete disintegration, whereas the Tennessee river sand, having a water cement ratio of 0.800, with practically the same compressive strength of 3328 lb., showed 15 cycles to obtain complete disintegration.

"Thus, after being satisfied with the quality of the materials, came the real important part of obtaining and controlling good concrete throughout the job. Specifications call for the different classes of concrete as follows:

	Water-cement ratio	No. bags of cement	28 days strength
Class "A"	6.3 gal.	6 bags	2500 lb.
Class "S"	5.5 gal.	6½ bags	3400 lb.
Class "F"	5.5 gal.	8 bags	3400 lb.

"Class A concrete was to be used in the piers, Class S was used in all other parts except in the handrails, and the Class F in the handrails only.

"The average of the results of tests were very satisfying and shows that we obtained excellent concrete throughout the work. The average strength of our Class A concrete was 3061 lb. with a 5.5 in. slump. At this point, I want to state that this slump measure was taken at the central mixing plant and decreased from ½ in. to 1 in. by the time it reached the site. These strengths gave us 400 lb. more per square inch than the specifications called for. In no instance did our concrete fall below the designed strength."

Robert L. Fox, city engineer, Bethlehem, Penn., gave a fine sales talk on limestone sand based on his own experience in the municipal work in Bethlehem. Abstracts follow: "A construction material which has given excellent results and has saved $134,000 for the builders besides returning a profit to the industry, all within a territory with a radius of about five miles, merits consideration and further development by all those interested in bringing about further economies in capital and current expenditures:

"Through the use of stone sand upon concrete street paving during the past six years, the City of Bethlehem has saved in first cost an amount such that if properly invested would return sufficient funds to annually pay for maintaining the joints.

"The outstanding features of the Bethlehem streets, where this material has been used, are as follows:

(A)—Through a higher strength mortar, which is natural to this particular stone sand with good cement and of normal consistency, the streets are opened to traffic in five days.

(B)—They do not scale (except in a few places involving a small yardage and which has been due to surface freezing from improper protection.

(C)—The mortar adheres to the surface stone after years of service.

(D)—Their riding qualities have improved and kept pace with the better riding qualities that have been secured in highway construction from year to year and compare favorably with concrete paving constructed elsewhere in this district.

(E)—Since an improved design was adopted in 1928 they have been free from construction cracks.

(F)—They do not require additional help in finishing.

(G)—Laboratory tests have shown that the mortar absorbs less moisture from immersion than mortar made from either the Standard Ottawa Sand or the Delaware River Sand.

"To ascertain the extent to which this product is used and the experience of others, the writer sent a questionnaire to highway departments of 29 states and their answers are not only of interest, but of great value to this subject.

"Fourteen state highway departments out of 29 permit the use of manufactured stone sand in amounts varying from 25 to 100% of the total sand requirement.

Four highway departments, not permitting its use, state there is no demand for its consideration in their territory as there is plenty of natural sand available at a price at which manufactured sand could not successfully compete.

"Twelve highway departments, not permitting its use, state that they have not performed experiments to be able to judge intelligently from actual observations.

"Eleven highway departments out of the 29 have made tests ranging from field observations and laboratory tests to the actual construction of a section of a road for experimental purposes.

"1. It is to be observed and is rather significant, that the replies from every state highway department, having either conducted experiments or having used stone sand, approve its use either entirely or else as a percentage of the total sand requirement.

"2. It is to be observed that the principal criticisms mitigating against its use are:

(a) Difficulty in securing a properly graded product.

(b) That which is principally due to lack of proper grading—poor workability.

(c) That which is in many cases largely due to gradation—less compressive strength than natural sand.

"3. The apparent lack of interest upon the part of the stone industry in some states in interesting the state authorities in the use of this product, as it is found that the engineering departments have not performed experiments due to the non-existence of suitable material for such purposes.

Conclusions

"The viewpoint of engineers, architects and contractors unfamiliar with this product, with whom I have come in contact, is in general skeptical as to its use. This seems to be based upon their belief that they will not secure a properly graded product, requiring an unsatisfactory water content and increasing the cost of finishing. In general, they do not question the strength of the finished product.

"It would, therefore, seem a matter of wisdom for the producers considering the marketing of this valuable byproduct or enlarging the field in which they are now selling, to ascertain by exhaustive test the proper grading of their material for best results.

"When it is realized that the Bethlehem Mines Corp. has, in the last few years, marketed 1,012,000 gross tons of commercial concrete stone, and has during the same time sold 244,000 gross tons of limestone sand without any especial treatment except washing, it is evident that this is a field in which many in the crushed stone industry are warranted in expending considerable thought, time and effort in not only rendering a service to the public, but that which is of prime importance in any business, a larger return upon the capital invested."

Ready-Mix Concrete

Henry D. Johnson, Jr., construction engineer, Division of Bridges and Structures, Department of Public Works, Pittsburgh, Penn., opened the discussion of ready-mix concrete with a paper on its use in the city of Pittsburgh. He said in part: "The radius of operation of the premixed concrete manufacturer is limited by the nature of his product, and consequently he is more interested in local public works, such as those of cities, townships, or counties, than in state or federal works programs. The *Engineering News Record* reports that in 1931 the political classification of public works contracts is as follows: state, 41.4%; municipal, 31.3%; federal government, 19.8%; county, 7.3%; and township, 0.2%.

"From these figures it can readily be seen that premixed concrete manufacturers as a whole have as their immediate field the concrete sales possibilities on 38.8% of the total public works contracts of the United States. It is doubtful if more than 3½% of the total concrete used in the United States was manufactured by premixed dealers during 1931. It, therefore, appears that the opportunity for increasing the use of premixed concrete is tremendously great.

"With the exception of some of the very large water works and dam projects, all branches of governmental construction work on which concrete is used can be adequately and efficiently served by a modern premixed concrete plant. Many municipalities are

using premixed concrete throughout the United States, due to the energetic personalities of many of the pioneers of the industry, but even in the Pittsburgh district where both the city and county department of public works have both been allowing the use of premixed concrete for the past six years, a large percentage of public works concrete is still being made by the small job mixer. The city department of public works has no objection to the use of premixed concrete and on contract work has used premixed concrete for concrete bridges, retaining walls, pavement bases, pavements, foundations, floors, swimming pools, tennis courts, sidewalks, curbs, manholes, catch basins, piles, roofs, and ornamental work, with excellent results.

Unemployment Relief Work Profits by Using Ready-Mixed Concrete

"In addition to contract work, the city has purchased premixed concrete directly. For the past year the city of Pittsburgh has been carrying out a great many construction projects for the purpose of relieving the unemployment situation in Allegheny county. This work threw the city into the contracting business on a very large scale, in a very short time, with little or no equipment and poor facilities for carrying on construction operations. A careful study by the engineers of the department of public works showed the decided financial and operating advantages of purchasing premixed and delivered concrete for use on these jobs. A study of a particular project showed a saving of approximately $0.75 per cu. yd. by the use of premixed concrete.

"Contracts have been awarded to both centrally-mixed concrete manufacturers and to truck-mixed manufacturers; a gross of 14,863 cu. yd. of concrete having been purchased.

"The further development of the premixed concrete industry in the municipal field requires intelligent and aggressive advertising, and the dissemination of interesting and accurate information to the general public, elective officers, and public works engineers throughout the nation. A national educational campaign intelligently planned so that interesting and general data pertaining to premixed concrete would be placed before the eyes of the general public, economic and operating advantages called to the attention of elective officers, and technical data for the public works engineers, would promote the common interests of the members of the National Crushed Stone Association, the National Sand and Gravel Association, and the National Ready Mixed Concrete Association."

J. L. Shiely, president, J. L. Shiely Co., St. Paul, Minn., and treasurer of the National Ready Mixed Concrete Association, read a brief paper on his experience as a producer as follows: "The program designates my subject as 'Manufacturing and Selling Ready Mixed Concrete.' I would rather present it as my own experience in the development of our two plants in hope that some one else might profit and avoid annoying circumstances that we had to overcome.

"Honest, reliable concrete can be turned out only where the plant has been built to give full and easy control over the operation of proportioning and mixing. Of course, high-grade materials must be used. The weighing or proportioning must be done accurately and checked by frequent testing of both the materials and the concrete.

"Improperly built plants with poor and uncertain methods of control will hurt contractors and users and other concrete plants as well as the owners of such plants in the end by lessening public confidence in the method, so quality production must constantly be aimed at just as in every other line of successful industry today.

FULL and easy control over the operation of proportioning and mixing ready-mixed concrete is essential in producing a satisfactory product. Plants must be designed to enable such control. Proper equipment and a competent engineer with a thorough knowledge of concrete who can win the confidence of the consuming public are two important elements in creating a successful operation.

"This business which started from practically nothing five years ago has risen to a production of over ten million cu. yd. this season and plants improperly built have become obsolete in one season.

"While it was uphill work to interest engineers in the advisability of these methods at first, they are now keeping up with the development of the industry and are its strongest supporters.

"After all it is a short cut in the merchandising and placing of concrete and as such, it has its justification as an industry.

"Certainly it should be the material producer's business for he will shortly find himself at its mercy where the sale of his material is for concrete purposes in large centers of population.

"Let me sound a warning to anyone contemplating entering this business. Be prepared to engage and retain the best engineering service and advice obtainable, at least during the construction of your plant and your first season's operations. Then select carefully some engineer who is qualified as a concrete expert. He must, in a language that can be understood, inspire confidence that you are going to produce a consistent, high quality product and that he will see that it has the strength and workability desired.

"Now what seems a rather simple process, that has been in vogue for a long time, becomes a rather complicated matter when you agree to sell a workable concrete of a given quantity and a specified strength.

Know You Deliver Correct Yardage

"You must deliver the actual yardage of concrete or you have a dissatisfied customer. You must be absolutely sure of this to avoid complications.

"So you are first concerned about a study of your aggregates. Unless these are consistently well graded, it is much better to receive them in separate sizes and recombine. You will find many times that the difference between a profit and a loss in your operation as against a contractor's is your ability to grade properly and eliminate annoying variations which affect the workability demanded on the job.

"Then you must have the system of mixes that are designed to give you the best yield of workable concrete.

"And you will discover that slump tests and workability do not go hand in hand sometimes which requires additional compilation.

"You will also have to give consideration to the length of haul and absorption of aggregates to maintain your workability. Do not be surprised to find that highly absorbent stones such as limestone will give you very high strength tests because of this absorption and the aid it effects in the curing of the concrete.

"You must analyze your cement situation and determine whether to handle bulk or bag cement. Bulk, of course, is cheaper but you must also consider how many brands of cement you are going to handle and whether you are going to need storage for the different brands.

"If you are going to handle bulk cement, how you can best handle it to storage will also concern you.

"Then also will cement be received hot or will it be reasonably temperate? We have had some peculiar performances from the use of hot bulk cement during the last summer.

The Problem of Cold Weather Must Be Considered

"Will you have to heat the aggregates at any time during the year and to what extent —is another important consideration.

"If you have to heat your aggregates in large bins, special care must be taken to prevent a cone being formed in the bin, which will direct some unheated materials into batch hoppers during the batching operations. Immediately this results in lack of uniformity because obviously ice coated materials will carry moisture and lack absorption where warm, dry aggregates increase your water requirements.

"I would recommend dry heat as steaming of aggregates causes complications in water control and it is very important to maintain accurately this control.

"You might be interested to know that warm concrete sets up much faster and con-

trary to some experience in laboratories, we have found we get higher 28-day tests on warm concrete.

"In determining the type of plant, many things must be taken into consideration. What will your peak demand be—because, after all, like any other business, you must have volume to make money. You must not be out of the market because several jobs decide to take advantage of weather conditions and pour the same day. You must have plant capacity and storage or continuous supply of materials for this peak demand.

"The size of the mixers must be considered in relation to the size of the hauling equipment to be used, and the hauling equipment in turn, should be considered in relation to the length of haul to reach your market. Short hauls may use smaller equipment but our experience is that the contractor wants the yardage as fast as you can give it to him when he is ready and we use almost all three yard equipment and three yard mixers. You can always mix a 1, 2 or 3 yard order in a three yard mixer. We are hauling in some cases thirty miles but our biggest market would average about a 5-mile haul. Our ready mixed plants are located near our sand and gravel and stone production plants.

Ability to Perform Real Service Is Essential

"You must be ready to perform a 24-hour service at a rate at least three times what the contractor's own former capacity to produce was. You can readily see that when a contractor is ready to take concrete and the 3 yard load can be dumped in one minute, he is going to see, from his viewpoint, only the idle men on the job when trucks are not coming.

"The nerve center of your business, you will find, is the Order Department and the dispatcher, and make no mistake, keep these departments close together. Provide for some positive transmission of orders through the dispatcher to the mixing floor that precludes any chance of mistake for different trucks carrying different specified mixes must not be confused.

"We use the Telauto Graph manufactured by the Telauto Graph Co., of New York, and positive orders are transmitted and signed for electrically and instantaneously.

"You will find it desirable to also provide your dispatcher with street men who contact the user and anticipate his wants so the dispatcher can make the most economical use of his hauling equipment.

"As your business grows, you will find it desirable to have on hand service equipment such as hoppers, conveyors, buggies, ramps, etc., because you can get a greater use out of this equipment and justify the investment.

"The testing of your product must be done competently and here you will soon find room for general improvement. You will either have to establish relations with a responsible testing laboratory or put in your own for the purpose of paralleling the testing done by other institutions.

"I hope the engineers whose duty it is to devise methods of testing will give attention during these days of unemployment to some better determining methods than are now used. We want to extend as producers a certified guarantee to our customers and too often today we are embarrassed by not being able to account for lack of uniformity of tests. Too often we are forced to core slabs for owners to prove that cylinder tests have not been representative of the quality of concrete delivered, and the cores themselves might further complicate the seller, if a misplaced chute or other careless handling caused segregation.

"The wide use and increasing growth of demand for ready mixed concrete is caused, I think, by the momentum of the popularity of this form of construction procedure and it is not hard to sell if the distributor knows the widely variant factors of each job.

Know Economies You Effect

"The salesman must know the economies he can effect for the contractor, how he can eliminate key men and other payroll investment. He must show him the saving that can be made in the handling of cement bags. He must emphasize how easy it is to coordinate his work with your service. How he can save plant investment. You must show him your better control and that the probability of lack of grading in his own aggregates with the resulting lack of uniformity that may increase the amount of cement that he will be required to use to bring up low tests caused thereby. You must show him that if he leaves the matter of concrete to you, he will have more time to concentrate on his other problems. And lastly, that you are entitled to a premium for your better concrete (you may not get away with this last statement).

"We have lately convinced owners and architects that they could well afford to contract with us direct for our product at a given price which contractors could all use in making up their bids.

"I have tried in this paper to give to anyone contemplating engaging in this business some highlights that he might avoid some of the pitfalls. I should add that city ordinances and building codes often cause complications but these are fast being revised. The form of contract is very important also.

"I have not time to go into the matter of paving with ready mixed concrete but I will say that there is a need for a better method of placing concrete over mesh reinforcing from a truck on the sub-grade.

"I will close by emphasizing that ideas of this kind do not go over by their own momentum. You must convince those interested that you can produce consistently high quality concrete at a price that represents a saving to the contractor and owner."

From 25 to 300 Plants in Six Years

J. E. Burke, general manager of the Ready Mixed Concrete Co., Pittsburgh, Penn., and president of the National Ready Mixed Concrete Association, then discussed in a general way the whole subject of ready mixed concrete. He outlined the rapid growth of the business from about 25 plants six years ago to some 300 plants now. These plants have been developed to a point where one man with automatic equipment has absolute control over the production of 700 or 800 cu. yd. of concrete per day. A fairly large investment is necessary in plant and delivery facilities in order to produce a high grade product and deliver it promptly when wanted.

Delivery bodies have been developed and changed until they are now quite satisfactory. Delivery on schedule and without unduly tying up equipment is at present the big problem. He believes that the most satisfactory solution of this is to have a man constantly in contact at all important delivery points.

In the manufacture of concrete Mr. Burke believes that the proper grading of the aggregates plays a most important part and should be carefully watched in order to minimize complaints as to lack of workability. He brought out the point that when a buyer insisted upon adding water at the job his company had the buyer sign a card relieving the company of responsibility on account of taking control out of its hands.

Railway Ballast

A. P. Crosley, division engineer, Reading Co., Harrisburg, Penn., and chairman, Committee II—On Ballast of the American Railway Engineering Association, after praising the research work on ballast done by Mr. Goldbeck of the National Crushed Stone Association, gave a rather comprehensive review of the development of railway ballast specifications and the constant trend toward simplicity. Soundness is the most important consideration and soundness tests are being further investigated so that they may replace other tests and the number of tests be reduced. The methods of testing are being standardized for all railroads, and while the particular requirements are left to each road to determine sizes are not settled although the present A.R.E.A. recommendations are that 95% pass a 2¾-in. round hole, 40 to 50% pass a 1¼-in. round hole and not more than 5% pass a ¾-in. round hole. Too coarse sizing results in too much crushing under traffic

while too small sizing results in undesirable clogging. Mr. Crosley said that the stress formerly put on cement value was a detriment and it is no longer considered to have any great bearing on the selection of ballast.

A. T. Goldbeck supplemented Mr. Crosley's paper explaining with the help of lantern slides the work being done on this matter by the National Crushed Stone Association. In order to determine the amount of crushing and the stability of different ballast materials an apparatus was set up which showed the amount of settlement under various loads. These results were plotted and showed very marked differences as between rounded gravel and crushed stone. Further tests are to be made on various gradings of crushed stone. Angularity as common to crushed stone has been proven to have a very marked influence on stability.

Airport Stone

F. E. Swineford, chief engineer, Ohio Crushed Stone Association, Columbus, Ohio, spoke on airport requirements. He gave an excellent digest of the subject of airport paving with bituminous and asphaltic materials. He said that of the 1,480,000 sq. yd. of airport runways 91% are bituminous surfaced. These have been built at an average cost of $1.28 per sq. yd. Their average thickness is 6 in. and the length of a runway should not be less than 2500 ft. and its width from 50 to 100 ft. The principal requirements of runways are that the surface shall be nonskid and at the same time smooth. The strength requirements are not as great as for highways and the density of traffic is much less, and of course much cheaper construction is permissible than for highways. Crushed stone thoroughly penetrated with the bituminous material and with the surface sealed makes a most satisfactory runway according to Mr. Swineford.

Operating Problems

John P. Lockhart, attorney, New Castle, Penn., discussed motor truck delivery and its responsibilities and which while not strictly an operating problem, it is here put under this head for want of a better classification. Mr. Lockhart said the liability for injury or damage to a third party by motor truck operators depends on whether or not the company has direct control over the means of delivery. The producer is not liable where deliveries are made by an independent trucking contractor or owner, and when the producer stipulates only the time and delivery and does not define the route or details of transportation.

The liability of the company to a driver of a truck under the workman's compensation laws depends on whether or not the driver is an independent contractor or a contractor's employe. If the truck is owned by the producer company and operated by an employe of that company, liability of course rests with the company; but if the hauling is by contract with a trucking company the producer is not liable.

Quincy McBride, Aetna Insurance Co., New Castle, Penn., discussing Mr. Lockhart's paper emphasized the value of proper insurance against such hazards. He suggests that in the case of a contract with a trucker an insurance certificate be demanded of the contracting firm to avoid all possibility of the producer becoming involved.

Quarry Transportation

W. E. Farrell, president, Easton Car and Construction Co., Easton, Penn., discussed the movement of stone from the quarry face to crusher in a very comprehensive and illuminating manner. Abstract of his remarks follow: "To me your job is an exceedingly difficult one. A quarry operation is neither a manufacturing proposition like the production of automobiles which are first produced and then sold, nor is it a jobbing business like the manufacture of quarry cars which are first sold and then produced. Your limited amount of storage capacity prevents your running at top speed continuously. You are handicapped by unexpected orders to hold up shipments, and in mid-season you have not the facilities to produce all the stone that has been sold. The result of all this is that you have peak days or weeks when your output may be two or even three times the average tonnage you are required to produce for a corresponding period during the season.

"At this point I wish I were able to disabuse your minds of what I think is a rather prevalent error. So often I have heard statements to the effect that each quarry and its conditions are a thing apart, that what is being accomplished in one quarry cannot be expected of another; for instance, every trap rock quarryman claims that his rock is the very hardest, superintendents frequently tell us that they have the very best shovel operator in the United States. Personally, I believe that in general the obstacles to be overcome in one quarry do not materially differ from those in other quarries.

"The point is that I think superintendents should make an intensive study of their own operations. I think they should be given an opportunity to visit other quarries, where they should take notes and make similar observations in these quarries.

"I speak of your making detailed observations and keeping careful records of your different operations in your own quarry but remember, knowledge of good practice is never based on one operation or observations made in one plant, it is the net result of many observations in many plants.

"If you will purchase nothing else except a stop watch and make use of it, you will find out most interesting facts and many chances for improvements in your plant between the quarry face and the mill.

"As a start, you might investigate your shovel operation from some of the following angles; others will occur to you:

"Over the period of a day, what is the absolute average number of dipper loads to fill your hauling unit?

"Over the same period, what is the average dipper interval, expressed in seconds?

"How much does your dipper hold on the average, expressed in tons?

"What is the percentage of lost time in shovel operation per day and per season, and how is this percentage of lost time divided between casting, moving, repairs, etc.?

"What percentage of the shovel delays are due to your transportation facilities and what per cent to your crusher?

"Now, as to your transportation equipment, you should become informed, among other things, on:

"What is the average time and also the best time required for your train or trucks, or whatever you use, to travel from the shovel to the crusher and from the crusher to the shovel?

"What is the average time required to dump each of your hauling units into the crusher?

"How many tons does each of your hauling units carry on the average?

"I might suggest the consideration of rearranging the route of travel, of improvement of conditions at the crusher, the use of larger or smaller hauling units, or larger or smaller dippers, or the relative efficiency of ball or roller bearings as compared with brass bearings.

"And, as regards the crusher:

"What is the average interval at which each car or truck could leave your crusher?

"Have you any jams in your crusher and what are the causes?

"Why do some people enclose their crushers and others do not?

"What percentage of what you crush goes into dust, waste, or unsaleable fines?

"I have no doubt that all of you can and would possibly answer these and any other questions I might raise, but my plea is for you to be able to back up your answers with definite knowledge derived not only in your own plant but in other plants as well, in case your replies are questioned you can speak with authority.

"I might illustrate what I mean by telling you my records on three plants, not so far apart, all using practically the same size dippers, cars and crushers. At one plant the shovel operated as a rule only 25 minutes out of every hour. At the other about 46 minutes, due largely to casting and the way the stone was broken up. The trains at each of these plants were made up of the same number of cars, yet at one plant the loading time was 4½ minutes, the other 6, and at the other 13½ minutes. The dumping time at one plant was 3½ minutes, at the second 5½, and at the third 6 minutes.

"I have timed a great many dipper swings and find the average swing in almost any quarry with any sized dipper and either steam or electric shovel is 30 seconds.

"For those who operate trucks and have an adequate supply of them, your truck interval at the crushers ought to average around 20 or 30 seconds. In many cases it will average fully twice this. These figures are affected by the size of the crusher or its hopper, whether there is a feeder and also whether the truck body is of the side or end dump type.

"As time goes on, the pressure for lower and yet lower costs and more and more stone will continue, and if you cannot produce or tell why you cannot produce more, or tell how it can be done, your place may be taken by others.

Trucks vs. Railroads

"My investigation to date has led me to believe that for hauls up to 3000 ft. round trip, the truck transportation is cheaper than car transportation, with the same tonnage. Truck transportation costs, I believe, run somewhat in a straight line; that is to say, they increase almost in proportion to the distance.

"It is very difficult to get the costs of car transportation because it is so difficult to get any information as to what it costs to maintain your trucks and shifts, whereas with truck transportation it seems to be very easy to arrive at the costs."

Safety Awards

Scott Turner, director, United States Bureau of Mines, Washington, D. C., at the annual banquet of the Association, presented the *Explosives Engineer* trophy of the Association to the Cape Girardeau plant of the Marquette Cement Manufacturing Co., for its splendid safety record—having won the trophy for three years in succession, the trophy becomes its permanent property. **E. M. Gould** of the Marquette Cement Manufacturing Co. accepted the trophy with the appropriate remarks.

Agricultural Limestone

Dr. J. W. White, professor of soil technology, in charge of soil research, Pennsylvania State College, State College, Penn., at the annual meeting of the Agricultural Limestone Products Association, discussed very interestingly the history of the use of lime in American agriculture from the very earliest time down to the present. Until 1909 when the effect of cement dust on a clover field near the Edison Portland Cement Co. plant in New Jersey was first observed ground limestone was not used for soil liming purposes. Since then the growth in the use of limestone has been steady and now about 86% of all agricultural liming material is ground limestone. Dr. White sketched the competition that had come into the field and stated quite specifically that some very improper propaganda had been used by both sides, and to clear up the situation he had engaged in very extensive experiment station work at State College. First he laid to rest the claim that burnt lime destroyed the humus in soils. Next he settled the claim that magnesium had a toxic effect on soils, quoting figures which proved in each instance that there is very little difference between the effect of lime and limestone, or between high calcium lime and the magnesium lime. The difference in neutralizing ability in favor of magnesium limestone, which has been much exploited by magnesium limestone producers, has very little practical significance since it is based on purely laboratory results which do not work out in field applications. He said that local soil conditions determine to some extent whether to use lime or limestone, but the main factor is the economy to the farmer, and that the state now recommends to farmers that they buy any form of lime, burnt lime, hydrate or limestone, which is the cheapest laid down on the farmer's land. He found fault with the Ohio agricultural lime law, which he said had created a great deal of confusion in the minds of Pennsylvania farmers. This law attempts to draw a distinction between the various forms of agricultural lime and to evaluate their usefulness to the farmer.

Officers Reelected

A. L. Worthen was reelected president of the Association and the other officers and directors were reelected with one or two exceptions. One new producer was added to the board of directors—Geo. F. Hammerschmidt, Elmhurst-Chicago Stone Co., Elmhurst, Ill., in place of W. P. Hodgkins of the Moulding-Brownell Corp., Chicago, Ill. New directors representing the Manufacturers' Division of the National Crushed Stone Association are A. Goldberg, Allis-Chalmers Manufacturing Co., Milwaukee, Wis.; Bruce G. Shotton, Hendrick Manufacturing Co., Pittsburgh, Penn.; L. W. Shugg, General Electric Co., Schenectady, New York.

Entertainment

Otho M. Graves, chairman of the Pennsylvania Stone Producers Association's committee, together with other members of the committee, had charge of the convention arrangements and provided an entertainment that will long be remembered.

Manufacturers' Exhibit

The manufacturers exhibit while not as large as in previous years in numbers of exhibits or space used was particularly interesting and helpful. The General Electric Co. was awarded the silver loving cup, first prize for the most interesting exhibit. Honorable mention was awarded first to Niagara Concrete Mixer Co. for its vibrating screen exhibit, and second to the Bucyrus-Erie Co.

At the annual meeting of the Manufacturers' Division the following officers were elected: Chairman, Abe Goldberg, Allis-Chalmers Manufacturing Co., Milwaukee, Wis.; vice-chairman, C. H. Adamson, Stephens-Adamson Manufacturing Co., Aurora, Ill.; Lucius Beebe, Troco Lubricating Co., Philadelphia, Penn.; C. S. Huntington, Link-Belt Co., Chicago, Ill.; Thos. MacLachlan, Vulcan Iron Works, New York City; W. S. Nicol, Cross Engineering Co., Carbondale, Penn.

Registration—Producers

Acme Limestone Co.; A. W. McThenia, J. A. Rigg, Alderson, W. Va.
J. E. Baker Co.; S. W. Stauffer, York, Penn.
C. C. Beam, Inc.; C. C. Beam, Harry H. Brandon, Melvin, Ohio.
Bethlehem Mines Corp.; M. L. Jacobs, Bethlehem, Penn.
Blairsville Bluestone Corp., J. F. Noble, Blairsville, Penn.

Blue Ridge Stone Corp.; Abney Boxley, L. J. Boxley, Roanoke, Va.; J. L. Huff, Blue Ridge, Va.
Boscobel Granite Quarries, Inc.; W. T. Moulton, Jr., Richmond, Va.
Buffalo Crushed Stone Co.; A. J. Hooker, James Savage, Frederick N. Taff, Buffalo, N. Y.
Callanan Road Improvement Co.; B. R. Babcock, Harry E. Battin, J. R. Callanan, K. M. Callanan, South Bethlehem, N. Y.; B. R. Babcock, Jr., Feura Bush, N. Y.; Ronald Kinnear, Albany, N. Y.
Carbon Limestone Co.; Fred O. Earnshaw, W. H. Feather, P. E. Heim, Joseph H. Jackson, H. T. McCartney, Youngstown, Ohio; George V. Kuhn, Edinburg, Penn.; R. C. Shepherd, U. F. Masson, Hillsville, Penn.; Charles Jones, Lowelville, Ohio; Tom Van Der Waal, Poland, Ohio.
Carnegie Steel Co.; W. E. Donaldson, Pittsburgh, Penn.
Cedar Bluff Quarry; John F. Robertson, W. C. Sparks, Princeton, Ky.
Columbia Quarry Co.; E. J. Krause, St. Louis, Mo.
Connecticut Quarries Co.; F. H. Edwards, W. T. Gilbert, Elwood T. Nettleton, Roy J. Reigeluth, A. L. Worthen, New Haven, Conn.; R. D. Brewer, Plainville, Conn.; W. J. Cronan, William F. Quinn, Rocky Hill, Conn.
Consolidated Stone and Sand Co.; George J. Fredericks, Montclair Heights, N. J.
Cushing Stone Co.; W. J. Adams, J. C. Cushing, J. E. Cushing, Schenectady, N. Y.
Dolese and Shepard Co.; O. P. Chamberlain, Chicago, Ill.
Dolomite Products, Inc.; Harvey N. Clark, John H. Odenbach, Rochester, N. Y.
John T. Dyer Quarry Co.; Joseph A. Conway, F. T. Gucker, E. G. Souders, Norristown, Penn.; H. W. Craig, Harry Schwartz, Birdsboro, Penn.
Eastern Rock Products, Inc.; Earl Elmer, Latham B. Gray, A. Clarence Munz, A. S. Owens, Utica, N. Y.
Federal Crushed Stone Corp.; Hugh M. McNabb, H. E. Rainer, Buffalo, N. Y.
General Crushed Stone Co.; Otho M. Graves, D. C. Hickey, Frank S. Jones, Redington Moore, B. P. Rex, John Rice, Jr., H. F. Yotter, Easton, Penn.; Jesse E. Miller, Gradyville, Penn.; E. E. Dotter, Glen Mills, Penn.; H. B. Allen, Philadelphia, Penn.; P. H. Jacoby, Quakertown, Penn.; E. W. Faylor, White Haven, Penn.; A. G. Barres, Wilkes-Barre, Penn.; Guy W. Faylor, Port Deposit, Md.; T. A. Lanagan, Winchester, Mass.; J. D. Hawthorne, Akron, N. Y.; W. J. Weiman, Auburn, N. Y.; W. J. Hinds, Lacona, N. Y.; Grover J. Murphy, Frank Taylor, Little Falls, N. Y.; L. M. Croll, Phelps, N. Y.; George E. Schaefer, J. K. Scott, Rochester, N. Y.; Meredith Bovee, F. F. McLaughlin, F. C. Owens, A. G. Seitz, W. L. Sporborg, Syracuse, N. Y.; H. R. Cox, L. H. Putnam, Watertown, N. Y.
Genesee Stone Products Corp.; G. L. Buchholtz, A. B. Caldwell, Batavia, N. Y.
Great Notch Corp.; D. C. Britt, Newark, N. J.
Grove City Limestone Co.; R. H. Albright, Harry J. Filer, Sharon, Penn.
M. J. Grove Lime Co.; James H. Grove, Frederick, Md.
Industrial Silica Corp.; R. G. Forman, Youngstown, Ohio.
Lake Erie Limestone Co.; William M. Andrews, A. McKinven, Youngstown, Ohio.
Lambertville Trap Rock Co.; John J. Crawley, Montclair, N. J.
John S. Lane and Son, Inc.; A. F. Eggleston, Arthur S. Lane, Meriden, Conn.
Lehigh Stone Co.; W. R. Sanborn, Kankakee, Ill.
Le Roy Lime and Crushed Stone Co.; J. L. Heimlich, W. A. Heimlich, Frank M. Howe, George E. Merchant, Le Roy, N. Y.
Lima Stone Co.; Charles Killen, Lima, Ohio.
Lynn Sand and Stone Co.; W. D. Manchester, Swampscott, Mass.
Malden Crushed Stone Co.; M. McDonough, Saugus, Mass.
Marble Cliff Quarries Co.; Eugene W. Davis, E. J. Kaufman, W. H. Margraf, Russell Rarey, Columbus, Ohio.
Marquette Cement Manufacturing Co.; E. M. Gould, Cape Girardeau, Mo.
Massachusetts Broken Stone Co.; Lawrence Robinson, Greenfield, Mass.
McCrady-Rodgers Co.; W. Rex Cullison, Pittsburgh, Penn.
National Limestone Co.; A. L. Sheffer, Samuel Sheffer, Naginey, Penn.
New Castle Lime and Stone Co.; W. W. Duff, Ellwood Gilbert, New Castle, Penn.
New Haven Trap Rock Co.; Albert D. Blakeslee, George E. Hall, William E. Hilliard, Alexander McKernan, C. A. Munson, New Haven, Conn.; E. T. Perry, Providence, R. I.
New York Trap Rock Corp.; L. F. Miller, Greer Tomlins, Haverstraw, N. Y.; E. L. Heidenreich, Jr., Newburgh, N. Y.; T. J. Kelleher, Verplanck, N. Y.
North Jersey Quarry Co.; F. W. Schmidt, Jr., John H. Schmidt, I. W. Wortman, Morristown, N. J.
Ohio Marble Co.; A. Acton Hall, Piqua, Ohio.
Old Colony Crushed Stone Co.; E. R. Atwood, Quincy, Mass.
Orange Quarry Co.; Samuel F. Dixon, West Orange, N. J.
Pekin Stone Products Corp.; E. K. Webster, Lockport, N. Y.
Pittsburgh Limestone Co.; A. W. Worthington, Pittsburgh, Penn.
Reinhold and Co., Inc.; H. E. Appell, P. B. Reinhold, Pittsburgh, Penn.
Rowe Contracting Co.; H. R. Brownson, Malden, Mass.
Ryan Quarries, Inc.; James A. Ryan, Albion, N. Y.
Servtex Materials Co.; Max A. Altgelt, New Braunfels, Tex.
Southwest Stone Co.; W. F. Wise, Dallas, Tex.
Steacy-Wilton Co.; F. M. Wilton, Wrightsville, Penn.
Universal Atlas Cement Co.; R. H. Boyles, Pittsburgh, Penn.
Van Camp Sand and Gravel Co.; H. A. Johnston, Lebanon, Ohio.
Warner Co.; G. J. Purnell, Irving Warner, Philadelphia, Penn.
West Penn Cement Co.; F. C. McKee, Butler, Penn.; G. A. Morrison, Dormont, Penn.
West Roxbury Trap Rock Co.; C. A. Crowley, Boston, Mass.; F. J. Long, Bernard A. McKinney, West Roxbury, Mass.
Weston and Brooker Co.; T. I. Weston, Columbia, S. C.
White Rock Silica Co.; R. W. Clarke, J. R. Fry, Greenville, Penn.
Whiterock Quarries; Ray C. Noll, Bellefonte, Penn.; F. M. McGuire, Pittsburgh, Penn.
Wickwire-Spencer Steel Co.; F. P. Clark, Buffalo, N. Y.; W. E. Foote, Gasport, N. Y.
Yoch and Roberts; C. R. Roberts, Norristown, Penn.
York Valley Lime and Stone Co.; F. W. Cramer, York, Penn.

Incorporates to Develop Silica Deposit

THE SOUTHERN SILICA CO. is the name of a new company incorporated with head offices at Etowah, Tenn. It has an authorized capital of 5000 par value of $100 per share; 750 shares to be sold for equipment and machinery and reserve. The purpose of the company is to mine and market silica at a deposit which it has in Fannin county, Georgia. It is 100 ft. thick and 5000 ft. long and the lowest assay is 96.6% SiO_2.

Hubert O. DeBeck, geological engineer, has recently visited this deposit and in his report states: "It is reasonable and logical to assume that the conditions and relationships obtained in the present surface extend to a depth of 500 ft. at least and probably to a depth of 1000 ft."

The management of the company will be vested in the following: President, John Reed, vice-president, First National Bank; vice-president, E. M. Shelley, president of First National Bank; secretary and treasurer, O. L. Reed, of Reed Bros., merchants; general superintendent, J. D. Parks, all of Etowah; sales manager and consulting engineer, J. B. Carper, Louisville, Ky.—*Etowah* (Tenn.) *Enterprise.*

To Install New Type Clinker Coolers

THE CONSTRUCTION of three large coolers for the kilns at its Cape Girardeau plant, the first of their kind in this country, was announced recently by R. Moyle, Sr., general manager for the Marquette Cement Manufacturing Co., Chicago, Ill. These coolers will be the Lee type.

"We are not in any way increasing production of the plant nor its production capacity, but we are striving to put that quality in our cement which will make Marquette's cement still better," Mr. Moyle told a reporter. The company in installing the new coolers is pioneering in a new engineering field with respect to manufacturing.

The system will provide for the rapid cooling of cement clinker without the use of water. Mr. Moyle said that a report that the company was going to spend a half-million dollars on the Cape Girardeau plant is unfounded, as no such program is contemplated at present.

Ten new coolers are being added at the LaSalle, Ill., plant. During the past year the company erected a huge raw mill and installed a new type of cement clinker grinder.

The present construction program will continue until about the latter part of March, Mr. Moyle said. He was optimistic about the future of the plant's operation and expressed a view conditions would be changed for the better in the industry later on.—*Cape Girardeau* (Mo.) *Missourian.*

[The Lee process coolers are said to cool the clinker very quickly by air forced up through grating over which a drag conveys it. The air leaves the clinker at about 1000 deg. F. and goes directly to the kiln. The result is a greatly reduced fuel consumption per barrel. It is said that the rapidly cooled clinker is much easier to grind and results in cement of much higher strengths.—THE EDITOR.]

New Sand Plant in Oklahoma

THE Makins Sand and Gravel Co., Oklahoma City, Okla., has just completed a new 20 car per day capacity plant at Sulphur, Okla. This plant is a change from local practice in that it uses a 1¼-yd. P & H shovel in the pit and trucks for pit to plant delivery instead of dredging.

The truck delivers to a receiving hopper above a 15-in. by 36-in. Diamond roller bearing jaw crusher. The crusher serves a 16-in. conveyor belt that delivers to a double-decked Simplicity vibrating screen. The oversize is returned to a second Diamond crusher (8-in. by 36-in.) and is conveyed back to the scalping screen.

The material then falls to a Telsmith log washer, after which it is elevated on a 16-in. belt conveyor to a triple-decked Simplicity vibrating screen where the classifying is done. The material falls to bins below. From the bins the aggregates are fed by adjustable electric feeders to a belt conveyor that delivers to cars.

Fire Destroys Jumbo Plaster Plant

FIRE destroyed the plant of the Jumbo Plaster and Cement Co. at Sigurd, Utah, January 27. Damage was put at $500,000.—*Chicago* (Ill.) *Herald and Examiner.*

Sand and Gravel Producers Put Emphasis on Production and Stabilization

Pittsburgh Convention One of the Best in the History of the Industry

AT the sixteenth annual convention of the National Sand and Gravel Association held at the William Penn Hotel, Pittsburgh, Penn., January 27-29, particular emphasis was laid on operation, one entire session being devoted to three papers prepared by prominent operators under the auspices of the United States Bureau of Mines. These three papers cover nearly all phases of sand and gravel operation and were perhaps the most interesting and important feature of the program. They appear below in abstract.

Methods and Costs of Mining and Preparing Sand and Gravel at the Plant of the Ward Sand and Gravel Co., Oxford, Mich.*

By Frederic L. Ward†

President and General Manager, Ward Sand and Gravel Co., Oxford, Mich.

THE Ward Sand and Gravel Co. began operations in 1915 at Oxford, Mich., with two 1½-yd. slack-line cableway systems and a standard Dull washing, screening and crushing plant of approximately 400-cu. yd. per day capacity. Later, two more slack-line cableways and another screening and washing plant were added.

About 1920 the cableways were abandoned and a dredge was installed having a 16-in. 514 r.p.m. dredge pump and a booster pump of the same size in the discharge line which elevated the material 70 ft. Both pumps were made by the American Manganese Steel Co. and were driven by 400-hp. motors.

In 1924 the plant and dredge were moved to the center of the property and the present screening plant built.

The so-called Ward jet was first used for mining sand and gravel in 1925. That it has been satisfactory is shown by the fact that the company has never been short of material and during the last two years has shipped every car on the date ordered. Capacities have been secured which could not have been obtained by the ordinary hydraulic method of handling material without a large investment.

It has also resulted in a lower production cost and a lower power cost per ton than with other types of equipment. Numerous experiments and changes, accompanied by many failures, have been made since its first installation. It is now believed, however, that it is giving maximum results with minimum cost and that sand and gravel can be mined by this method cheaper than by any other—provided, of course, that the deposit is suitable.

Improvements made during the last two years have resulted in approximately the same cost per ton f.o.b. cars as in 1928 and 1929, although at present much more of certain sizes is being wasted. This waste, amounting to approximately 50% of the material excavated, is due to the fact that there is little demand for small sizes at this time. The cost of wasting material is approximately the same as the cost of loading on cars. If the same percentage of material excavated was being shipped as in 1928 and 1929, operating costs would not be more than 25% of what they were when operating the standard suction dredge. The following table shows tonnage shipped and production costs per ton f.o.b. cars since 1927:

Year	Tons	Production cost per ton
1928	1,825,731	$0.19
1929	1,876,970	0.12
1930	1,124,979	0.137
1931 (7 mo.)	487,059	0.117

Another problem which has been solved is the maintenance of low production costs on

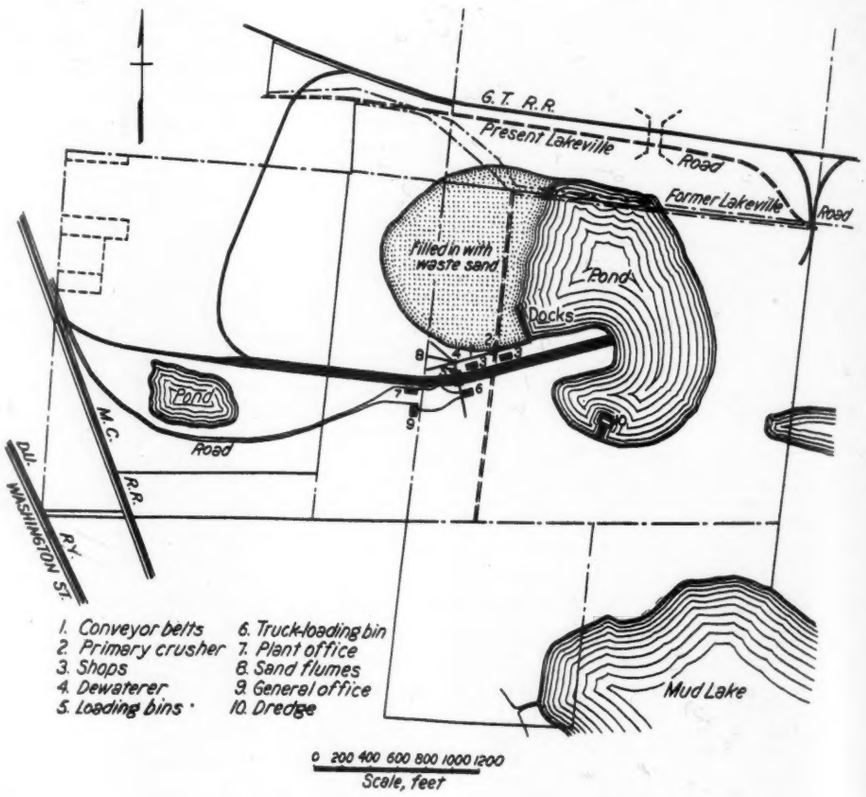


Fig. 1. Map of property of Ward Sand and Gravel Co.

*Abstract of paper presented at the annual convention of the National Sand and Gravel Association at Pittsburgh, Penn., January 27-29, 1932.

†One of the consulting engineers, U. S. Bureau of Mines.

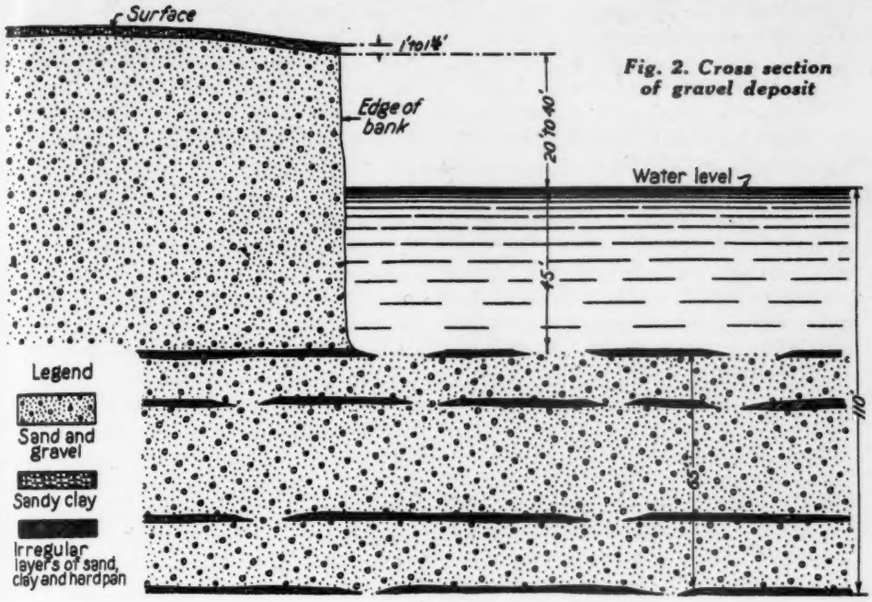


Fig. 2. Cross section of gravel deposit

a tonnage approximately 30% of that formerly shipped. In other words, production can vary from 50 to 80 cars per day with approximately the same operating costs per ton that are obtained when 150 to 240 cars per day are shipped. This applies to operating costs only and does not include administration or depreciation.

Geology

The deposit at Oxford is of glacial formation and covers several thousand acres. The good gravel lies on comparatively level ground containing several small lakes. To the north and west there are clay hills near which the coarse gravel is most abundant. In places, and particularly on the north side of the deposit, there is an overburden varying in thickness from 1 to 10 ft. To the south the deposit grades into sand at the water line. The same is true to more or less extent at the north. The deposit extends to a considerable depth at its center on the property of the company. Fig. 1 is a sketch map of the property showing the general layout of the plant. Fig. 2 shows a typical cross section of the gravel deposit.

The overburden consists of sandy clay from 12 to 18 in. thick which disintegrates readily. There is considerable soft, light stone above the water level over the entire area, but little of it occurs below the water. This soft stone is badly weathered and a large percentage of it disintegrates in being handled; this makes it difficult to keep the finished product clean and necessitates a final rinsing just before the gravel is loaded.

At a depth of from 45 to 90 ft. under water strata of clay or cemented material are encountered, which so far have proved impenetrable. This has prevented excavating to bed rock, which, as near as can be ascertained, is 110 ft. below water level. These strata are mostly blue clay, which fortunately does not break up into small pieces. The clay which is not caught on the dredging nozzle is removed by hand picking after the material passes over the scalping screens. A large percentage of the soft stone is removed in the same way. In case of cemented material the cementation is not strong enough to cause trouble, except that these strata cannot be penetrated when they are over a few inches thick. Yellow clay largely disintegrates while going through the plant, and few large pieces of it have to be removed by hand, as is the case with blue clay and soft stone.

Methods of Prospecting

In prospecting, holes were sunk to water level at different places on the property. The gravely is cemented sufficiently to allow sinking of holes with a post-hole digger, using an extension handle. At places where the water level is a considerable distance below the surface, it was necessary to sink shafts, which were cribbed with 2- or 3-in. sawed planks. No records of prospecting costs were kept, as the work was largely done by the operating crews during slack periods. Only a small acreage was purchased at first, additional lands being secured later. Few test holes were timbered; but where necessary timbering was done by contract. Possibly a hundred holes were dug or drilled.

For sinking holes below water level, the ordinary churn drill was used. No particular spacing was adopted, but holes were sunk

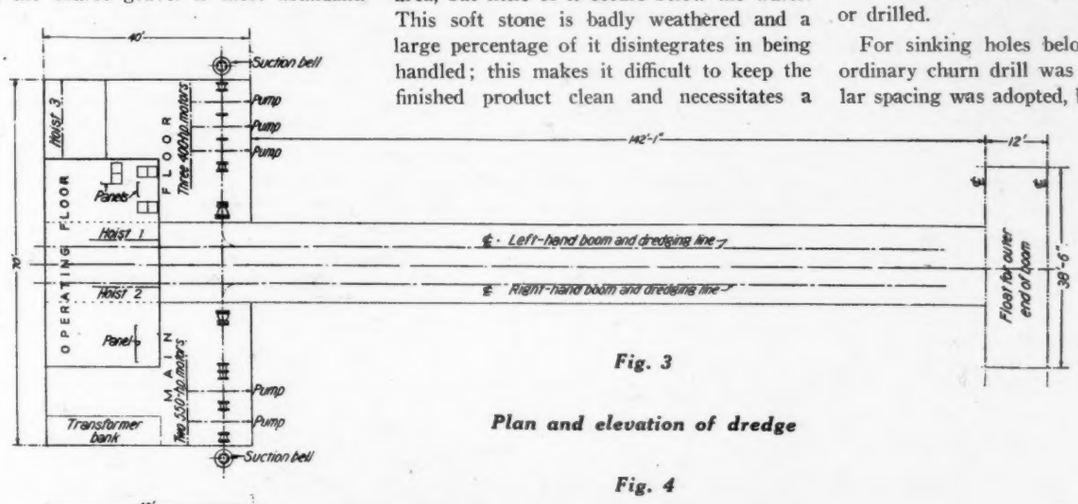


Fig. 3

Plan and elevation of dredge

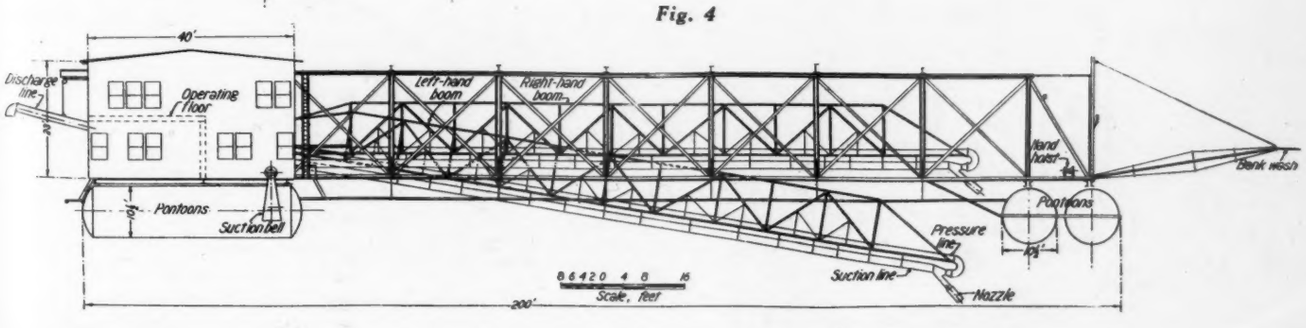


Fig. 4

wherever there were irregularities of any extent on the surface.

Choice of Operating Method

As soon as the deposit was well opened it was apparent that it should be operated by a hydraulic method, as a large majority of the good gravel lay under water. Furthermore, the deposit contains a larger percentage of sand and small stone than can be sold, and with hydraulic operation this material can be wasted cheaply. The cost of the equipment and lower cost of operation were also factors.

On account of the unusual depth of the deposit, it was early determined that some other method than that employing the ordinary suction dredge would have to be used. The best of the deposit is from 50 to 60 ft. below water level, there being a larger percentage of stone and a better grading of sizes at that depth.

The fact that the hydraulic jet works as efficiently in deep water as it does in shallow water was one of the deciding factors in adopting this equipment.

In building the dredge, booms for supporting the jets and suction pipes were made of sufficient length to allow dredging 110 ft. under water. The dredge has never operated at this maximum depth, but it has reached 97 ft. In later years the problem of handling oversize stone with the jet system has been solved, so that there is no interference with production unless the quantity of oversize is excessive—something seldom experienced. The desired output for the plant is an average of 16,000 tons per day. There is no drainage or disposal problem connected with the operation. Shipments are made almost entirely by rail, both the Grand Trunk and Michigan Central railroads having tracks into the plant.

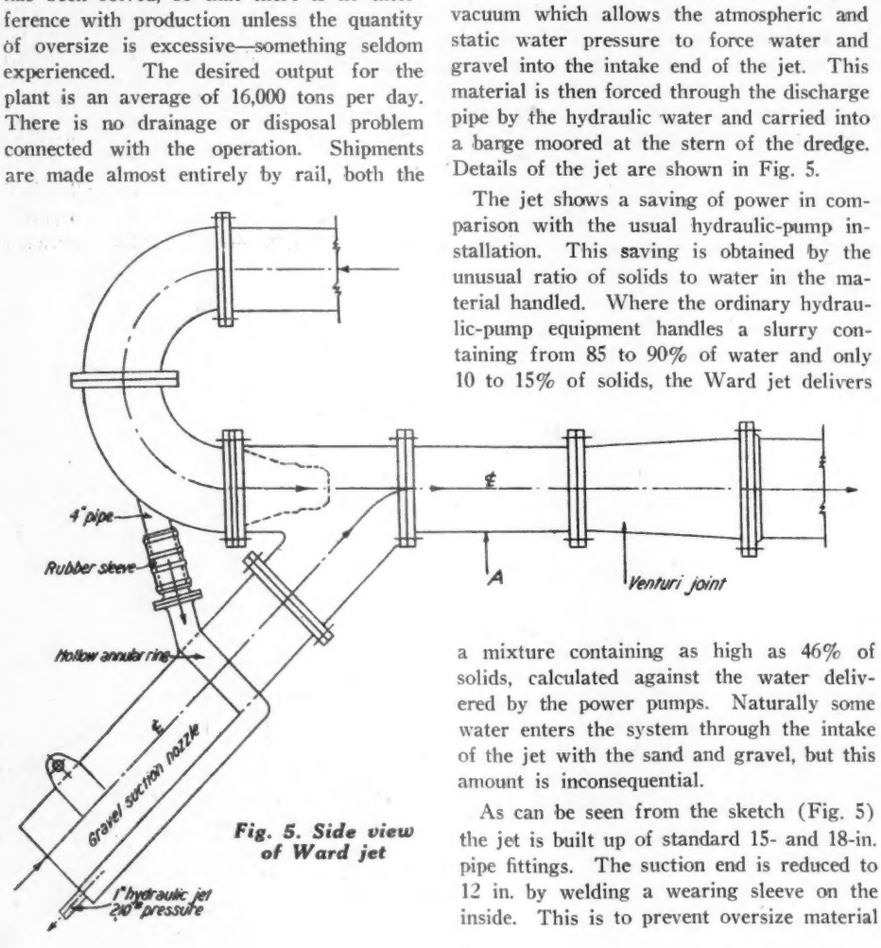


Fig. 5. Side view of Ward jet

Description of Dredge

The dredge is unique in that the gravel and sand are mined by hydraulic jets which operate on the same principle as a water ejector. The dredge assembly is T-shaped, consisting of a central or main structure of steel and timber, 92 ft. in beam over all and 40 ft. fore and aft, to the stern of which is attached a floating timber dock or runway 6 ft. wide and 300 ft. long with its length paralleling the beam of the main structure. This runway is used as a mooring dock from which empty and loaded barges are manipulated.

The main structure is supported upon six steel pontoons, each 10½ ft. in diameter and 40 ft. long, built of steel plate and braced to resist outside pressure. Forward of the main structure is a steel bridge extending 135 ft. This is supported at the bow by two steel pontoons of the same size. The bridge supports the two dredging lines which are 110 ft. long and are hinged at the main dredge. The construction is shown in Figs. 3 and 4.

The excavating is done by forcing water at high pressure (210 lb. per sq. in.) through a jet consisting of a nozzle with a relatively small opening which discharges into an expanded or tapered joint of pipe with a Y intake. The action of the jet is identical with that of a water ejector, causing a vacuum which allows the atmospheric and static water pressure to force water and gravel into the intake end of the jet. This material is then forced through the discharge pipe by the hydraulic water and carried into a barge moored at the stern of the dredge. Details of the jet are shown in Fig. 5.

The jet shows a saving of power in comparison with the usual hydraulic-pump installation. This saving is obtained by the unusual ratio of solids to water in the material handled. Where the ordinary hydraulic-pump equipment handles a slurry containing from 85 to 90% of water and only 10 to 15% of solids, the Ward jet delivers a mixture containing as high as 46% of solids, calculated against the water delivered by the power pumps. Naturally some water enters the system through the intake of the jet with the sand and gravel, but this amount is inconsequential.

As can be seen from the sketch (Fig. 5) the jet is built up of standard 15- and 18-in. pipe fittings. The suction end is reduced to 12 in. by welding a wearing sleeve on the inside. This is to prevent oversize material from entering the line and blocking the throat or Y. In the short section marked "A" in the sketch, a liner is inserted to take up the wear resulting from the impact of the gravel at this point. The wear on this sleeve necessitates turning it through an arc of 180 deg. every two weeks and complete replacement monthly. The sleeve is made of manganese steel 1 in. thick.

The first 32 ft. of the discharge line is turned one-third way around at frequent intervals to accommodate wear. This section must be renewed twice a season, but the balance of the discharge line will last a whole season, or about seven months.

The dredge is equipped with two Ward jets with their accompanying water and discharge lines, both of which are 110 ft. long and are supported by cables from the bridge of the dredge.

The water line is a 15-in. pipe and the discharge line is 18 in. in each case. These digging units are raised and lowered by electrically driven hoists on the main dredge structure. The 15-in. water line is hinged at the dredge by means of a swivel joint, and the gravel line is hinged by means of a rubber section 4 ft. long. This rubber sleeve is a 14-ply canvas hose with ¼-in. of rubber on the inside and ⅛-in. on the outside and fastened to the pipe with double iron clamps on each end. To guard against the sleeve becoming detached from the pipe because of the high water pressure inside, short pieces of cable are clamped from one pipe to the other across the sleeve.

The duplicate jets are powered differently, and the equipment for each will be described separately. It is seldom necessary to operate both jets at the same time, as one is ordinarily sufficient for production requirements, the other being held in reserve.

On one side the power equipment consists of two Allis-Chalmers centrifugal pumps with 14-in. intakes and 12-in. outlets, which have a capacity of 8000 gal. per min. when operating against a head of 220 lb. These pumps are direct-connected to two Allis-Chalmers, 550-hp., 4600-volt, synchronous motors.

These pumps, operating in series, discharge into the 15-in. pipe and supply power for one jet. A shut-off valve on the main line between the pumps and the jet may be closed when necessary, as when a stone too large to enter the intake is sucked up against it, thus stopping operations temporarily. This valve is operated by a 4-way hydraulic valve, taking water from the main discharge line of the pump. There is also a safety valve between the main shut-off valve and the pump, set at 230 lb. per sq. in., which allows the pump to continue running with the main valve closed.

The other jet is powered by three 14-in. Allis-Chalmers centrifugal pumps operating in series and each having a capacity of 7000 gal. per min. against a 160-ft. head. Each is direct connected to a 400-hp., Allis-Chalmers, induction motor. The initial pump

in this series is primed by a 6-in. Morris centrifugal pump direct-connected to a 100-hp. General Electric induction motor. This primes the first pump in the series and in turn drives the air from the two succeeding pumps and automatically primes them.

Electric power is delivered to the dredge as 4600-volt, 3-phase, 60-cycle alternating current, which is stepped down through two 4600- to 2200-volt, 200-kv.a. transformers and three 2300- to 220-volt 100-kv.a. transformers. The main pumps use current at 4600 volts and the priming pump and booster pumps use power at 2300 volts. The hoists, smaller motors and lights are operated on 220-volt current. All machinery is controlled through oil switches with push-button stops.

The power pumps require gland-packing adjustments annually and new packing usually every two years. No internal repairs have been required on these pumps since installation.

The dredge is moved by means of cables anchored at various points on shore and operated by a Thomas double drum hoist driven by silent chain from a 50-hp. General Electric induction motor.

The hoist used to raise and lower one of the Ward jets, is a 3-drum Thomas hoist, gear driven by a 90-hp. induction motor. One drum is used to raise the jet through two sets of sheaves—one at the bow of the dredge and one at an intermediate point on the bridge.

The second drum is used for moving the dredge from point to point and the third drum operates a steel basket over the intake of the jet, the function of which will be described later. On this hoist there are also two small auxiliary drums which raise and lower the gravel-discharge pipe to accommodate its positon to the barges being loaded.

The hoist operating the other Ward jet is a 2-drum Thomas hoist geared to a 100-hp. General Electric slip-ring motor. One drum is used to raise and lower the jet and the other operates a basket as described later.

The pump used to prime the three power pumps also has another function. When the power pumps are running, this priming pump operating through a 4-in. line to an ordinary fire-hose nozzle furnishes water at 60 lb. pressure at the bow of the dredge to cave the bank ahead of the digger and prevent undermining of the bank and subsequent damage. Boulders are removed from the suction end of the jet as follows:

When a large boulder is encountered, the jet is raised without stopping the hydraulic water. The suction thus causes the boulder to remain attached to the intake nozzle. It is only necessary to raise the jet a few feet to clear it from the gravel. Then an ingeniously designed steel basket is lowered on steel cable guides to the suction pipe where it automatically drops around and below the attached boulder. The hydraulic water is shut off, releasing the suction, and the boulder drops into the basket; it is then hoisted to the surface and removed by the man at the bow of the dredge.

All pumps are started and stopped by the operator stationed at the hoists on the dredge, and push-button stop control is available on all equipment. The crew of the dredge consists of one or two runners, depending on the production necessary, an oiler and two deck hands.

The gravel is discharged through an 18-in. line into steel barges moored at the stern of the dredge. This discharge line is covered by a ⅜-in. steel-plate hood forming a hopper 3½ by 4 ft. in section in which is placed a stepped screen with steps 8 in. long. Slot openings in each step are ⅜-in. wide at the upper end and ½-in. at the lower. The vertical drop in each step is 2 in. All gravel discharges over this screen, which removes the excess water and about 40% of the fine sand which is by-passed back to the lake. Fig. 6 shows an elevation of this step screen.

The barges are handled at the dredge by a single-drum Lincoln car puller gear-driven from a 15-hp. induction motor, and by four single-drum winches, each gear driven from a 5-hp. General Electric induction motor. Two of these winches are located on the central dredge structure and two are on the 300-ft. dock at the stern.

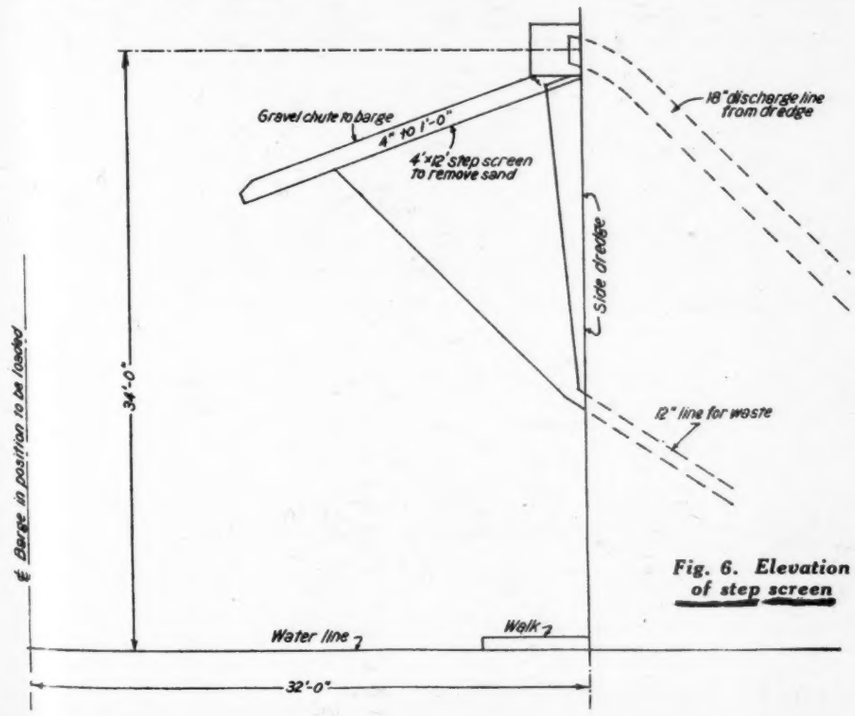


Fig. 6. Elevation of step screen

Transportation

Gravel is moved from the dredge to the washing and screening plant on shore by steel barges towed by small team tugs. The average length of tow at the time of writing this report is approximately one-half mile one way. A tug handles one barge only and requires about one hour for a round trip. The barges, 50-ft. beam and 116 ft. long, are of unique construction. Two of them are supported upon eight pontoons 10½ ft. in diameter and 40 ft. long and four pontoons of the same diameter and 36 ft. long; and one barge is supported on tweve 10½ by 40 ft. pontoons. The barge cargo is carried in a steel hopper 110 by 20 ft. in horizontal section at the top. The sides are sloped at 45 deg. and the hopper is approximately 12 ft. deep. At each end of this hopper screens of ⅜-in. punched plate are inserted, which allow the excess water to drain from the cargo and insure a comparatively dry material on arrival at the unloading dock. This cargo hopper, which has a capacity of 600 tons, is supported on and attached to the pontoons by suitable structural steel framing and bracing. A side view and plan of a barge are shown in Figs. 7 and 8.

Each barge is self-unloading through twenty-six 12-in. by 18-in. horizontal slide-gate chutes in the bottom of the hopper. The gates are operated by hand wheels through racks and pinions. They discharge directly upon a rubber conveyor belt 42 in. wide and approximately 140 ft. between centers. This conveyor belt operates horizontally beneath the hopper and rises at the head of the barge over an extended steel structure projecting about 30 ft. beyond the pontoons. The belt is driven by a 40-hp. Allis-Chalmers induction motor through a Falk speed reducer at a belt speed of 415 ft. per min. When the barge is brought to the unloading dock, power connection is made through a rubber-covered cable and proper plug and receptacle.

Conveyor System

The gravel as discharged from the belts on the barges to a small movable hopper over a belt upon a floating dock (Fig. 9). This belt runs at right angles to the discharge from the barge and operates on the floating dock for part of its length and then rises on land to an elevation of 15 ft. above

water level. The belt is 36 in. wide and 180 ft. between centers, the last 60 ft. rising 15 ft.

The dock belt discharges into a two-compartment steel hopper with a capacity of about 4 cu. yd. on each side. This delivers through chutes controlled by hand-operated rack-and-pinion, vertical-slide gates to two 36-in. conveyor belts 305 ft. between centers and having a rise of 32 ft. in their length. These two belts, termed "No. 1 Belts," are duplicates and it is seldom that both are used at the same time, one being sufficient for production needs. Their duplication is to provide auxiliary equipment in case of breakdown. They deliver dredged material to the primary crushing plant and are driven by two Allis-Chalmers 100-hp. slip-ring motors through Falk speed reducers and Falk-Bibby flexible couplings. The belts operate at a speed of 530 ft. per min. Both belts discharge over a grizzly constructed of 80-lb. rails 10 ft. long set at 4-in. spacing and inclined at 40 deg. The oversize on this grizzly passes directly to the primary crusher. The undersize drops into a wooden storage bin having a capacity of 30 cu. yd.

Side and top views of the unloading docks are shown in Fig. 9.

Primary Crusher

The primary crusher is a Cedar Rapids 14 by 36 in. jaw crusher set for 4-in. discharge and belt driven by a General Electric 75-hp. slip-ring motor. The crushed material from this unit passes to the 30-cu. yd. storage bin, which discharges through a roll feeder to a pair of conveyor belts in duplicate, called "No. 2 belts." This roll feeder consists of a small steel hopper with a V-shaped bottom, set directly over a steel roll 20 in. in diameter with a 24-in. face. This roll is operated at 67 r.p.m. by a chain-and-sprocket drive from the tail pulley of the No. 2 belt. The gravel discharged from the bin is controlled by a sliding gate on the bottom of the bin hopper. The roll is made of cast iron with a chilled-steel shell of ⅜-in. high-carbon steel which ordinarily will last one season.

The parallel No. 2 belts are 36 in. wide and 317 ft. between centers and rise 50 ft. in taking material from the crusher storage bins and delivering it to the washer plant. They are driven by Allis-Chalmers 100-hp. slip-ring motors through Falk speed reducers.

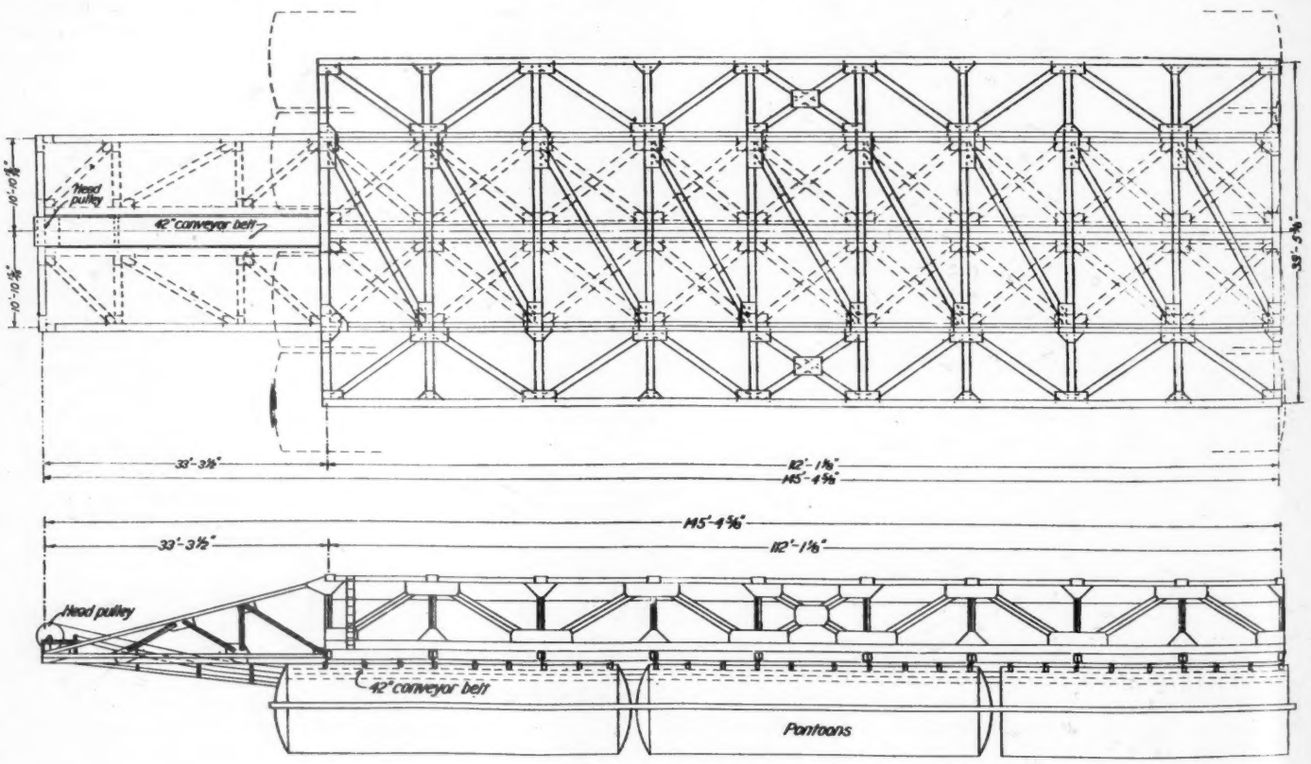
Washing and Screening Plant

The main supply of wash water enters the plant through a 15-in. pipe line, which is cut down at the discharge point to four 6-in. pipes—one on each side of each belt. The discharge is so arranged that the water flows under the gravel as it comes from the belt. Thus the gravel drops into the water rather than the water being discharged onto the gravel. This accelerates the flow of the gravel and makes a better mixture. The water is supplied by an Allis-Chalmers 12-in. single-stage centrifugal pump, which is direct connected to a 200-hp. Allis-Chalmers squirrel-cage induction motor operating on 2200 volts.

The material discharging from the No. 2 belts strikes against worn jaw-crusher plates, falls into the stream of water and is carried to the scalping screen, which is a 48-in. by 12-ft. trommel. The feed end of the trommel has what is known as a "rollerless bearing," and the discharge end is mounted upon a shaft and cast-iron spider. The screen plates are of ½-in. steel punched with 2½-in. round holes. A unique feature of these trommels is that new plate is put in and run until the inside edges of the holes show considerable wear. Then the plates are removed and the worn portion is built up by welding ⅛-in. Stoody self-hardening welding rod on top of ordinary welding rod which is used as a filler to replace the metal worn from the screen. This repair costs about one-half the original cost of the screen plate, but it gives the plate twice its original life. Each screen is driven by 15-hp. General Electric induction motor through a Falk gear reducer and a bevel gear on the discharge end. The oversize from the trommels is returned to the secondary crushers.

The undersize is sent to a 4 by 10 ft. stationary screen which has ⅜-in. round perforations in ¼-in. plate and is used to remove fine sand and silt from the gravel. Ordinarily there is a considerable quantity of this material to be removed. While much of the sand has been removed at the dredge itself and at other points along the line of operation, by far the greater portion of it is removed on this screen. To insure the maximum removal here, the screen is set on the flat slope of 18 in. To facilitate the movement of the gravel over this screen six water jets are provided in two banks of three each. These are made of 2-in. pipes flattened to ¼ by 3 in. The jets are set at an angle of 45 deg. with the screen and the water is supplied at 60 lb. pressure.

The undersize from this screen is passed through pipes and sand-settling boxes, which



Figs. 7 and 8. Plan and elevation of barge

will be described later, to sand storage piles over recovery tunnels. The oversize from these screens passes to a 4- by 10-ft. Hum-mer vibrator screen provided with ¼-in. mesh wire cloth. The undersize from this screen goes to sand storage.

The oversize passes to a second Hum-mer vibrator ⅜-in. mesh screen 4 by 8 ft. in size. The oversize from both screens falls directly to a cement-block silo 20 ft. in diameter by 25 ft. high with a capacity of 150 tons.

An interesting feature in the construction of the chute below the second Hum-mer screen is a series of 2- by 2-in. angle irons bolted to the wooden floor of the chute. Their function is to collect gravel in a series of small steps, thus providing a constantly changing wearing surface of the gravel itself, from which the material cascades to the concrete silo. The undersize from both Hum-mer vibrators goes to sand storage.

The oversize material from the scalping screen is chuted to a 30-in. rubber conveyor belt 35 ft. between centers, which is also used as a picking belt where all clay and soft stone is removed. The belt discharges to a 4- by 8-ft. trommel of local construction set on a slope of 2½-in. to the foot and operating at 15 r.p.m. The screen has 2¼-in. round holes in ½-in. plate and ordinarily wears three years. The oversize from this screen passes to a small hopper over the secondary crusher and the undersize falls directly to a concrete-block storage silo.

The hopper over the secondary crusher is of timber and has a capacity of 20 tons. It feeds directly through steel chutes and hand-wheel-operated rack-and-pinion gates to four jaw crushers. Two of these are 9- by 36-in. Cedar Rapids crushers, which are belt driven by 50-hp. Allis-Chalmers induction motors. The other two are 9- by 20-in. Cedar Rapids jaw crushers, one driven by a 40-hp. and the other by a 35-hp. General Electric induction motor. The discharge from all four crushers falls to a hopper feeding a 24-in. conveyor belt 125 ft. between centers, having a rise of 25 ft. and delivering to a hopper over the No. 2 belt which carries the material back to the washer, thereby forming a closed circuit.

Sand Storage

Undersize material from the washing plant is conveyed through a 15-in. pipe to three radiating series of sand boxes. These consist of 12-in. square sluices at the receiving end, on the bottoms of which punched plates are set having ¼-in. round openings. The velocity of the water at this point is such that oversize material and fine silt are carried over this screen and only the intermediate size, or mason sand, passes through. The coarse material, silt, and excess water emerge from this small sluice into a sand-settling box or series of boxes approximately 4 ft. square in cross section and fitted with baffles or dams at suitable intervals. The coarse sand is settled off in the first boxes, the fine sand next and the silt floated over the tail end. All sizes of sand are drawn from the settling boxes to the storage piles below through 2-in. stop-cocks with sliding, hand-operated shut-off gates. The waste water and floating silt returns through a 15-in. pipe to a sump constructed above an Amsco 12-in. single-stage centrifugal pump, direct-connected to a Westinghouse 350-hp., 2200-volt induction motor. This pump sends the silt and waste water through a 12-in. pipe approximately 1000 ft. in length to the waste dump.

Underneath the three radiating series of sand storage piles, which have a capacity of about 6000 tons, are three concrete tunnels 8 by 9 ft. in section—one 150 ft. in length and two 180 ft. long. Loading chutes, 12 by 16 in. in section, are spaced at irregular intervals along the tunnels and are fitted with arc-type hand-operated gates which feed to three 30-in. conveyor belts. All three belts have a rise of appromixately 18 ft. They discharge to a feed hopper over a sand belt 30 in. wide and 150 ft. between centers operating at an inclination of 15 deg. and discharging into a loading bin over the railroad tracks. This belt is driven 548 ft. per min. by a 75-hp. Allis-Chalmers induction motor through a Falk speed reducer.

Gravel Storage

From the concrete-block storage silo two No. 3 belts, 30 in. wide and 180 ft. between centers, operate in parallel (one being used as a spare). They are fed from the silo by steel chutes with arc-type overcut gates operated by hand levers. The No. 3 belts discharge through suitable hoppers to two parallel No. 4 belts, each 30 in. wide and 260 ft. between centers, elevating the gravel 38 ft. to the sizing plant The No. 4 belts feed a 4- by 9-ft. stationary, punched-plate step screen set at a slope of 30 deg. The steps are 2 in. on the slope by 1 in. drop, and the holes are 1¼- by 2-in. slots. The oversize from this screen falls directly to ground storage piles and the undersize falls to a 24-in. conveyor belt, 140 ft. between centers. This belt functions as three in that it receives and discharges material in three sections. The first section takes the undersize from the 4- by 9-ft. stationary screen and delivers it to two parallel 4- by 5-ft. Hum-mer screens having ¾-in. mesh cloth. The oversize passes directly to ground storage below and the undersize falls to a second section of the conveyor belt which transports it to two 4 by 5 ft. Hum-mer screens in parallel. These screens have ⅜-in. square mesh cloth. The oversize falls to ground storage and the undersize drops to a third section of the conveyor belt which takes it to a single 4- by 5-ft. Hum-mer screen with ¼-in. square mesh. The oversize drops to storage and the undersize also passes to storage through a spout.

All screen cloth is of high-carbon steel wire and has an approximate life of 150 hr. The stationary punched plate, when coated with Stoody self-hardening welding rod, has an approximate life of 200 hr.

The sizing screens are mounted upon a

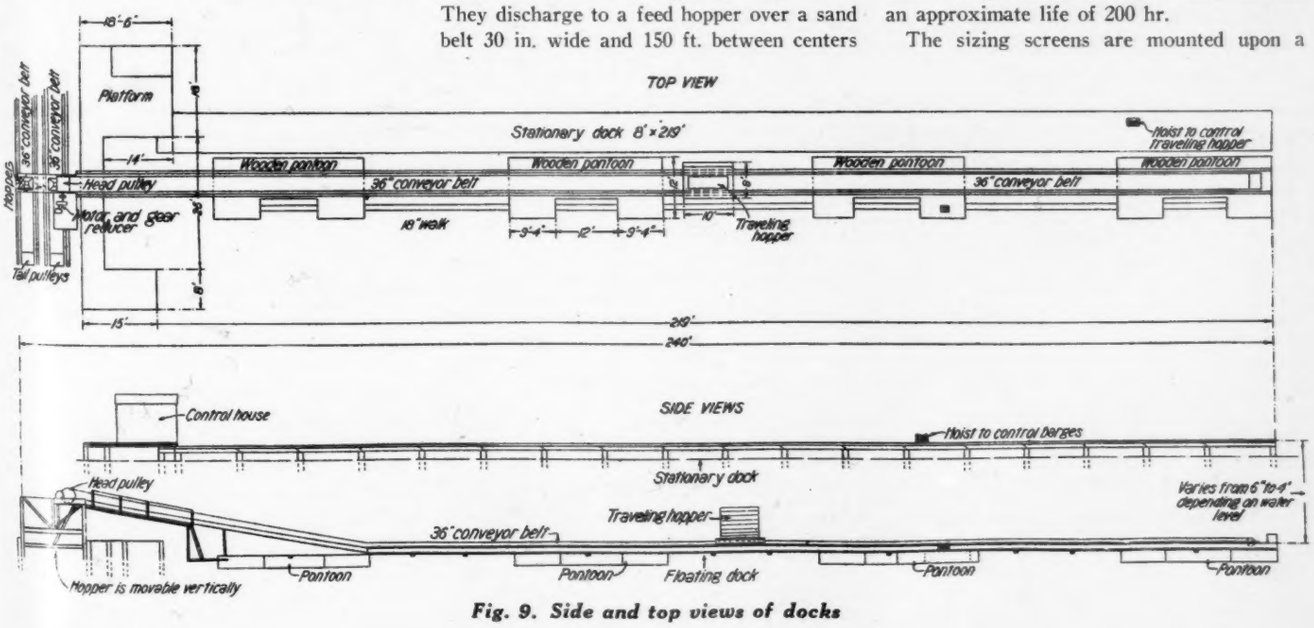


Fig. 9. Side and top views of docks

steel trestle 85 ft. above the ground storage which has a capacity of approximately 14,000 tons of gravel. Under the gravel piles is a concrete tunnel 280 ft. long and 8 by 9 ft. in section in which are steel chutes on 5-ft. centers. These chutes are equipped with arc-type lever-operated gates and feed to the stone-storage belt which is 30 in. wide, 380 ft. between centers, and rises 40 ft.

Material from the stone-storage belt is delivered to a 2-way hopper on one side of which is an Allis-Chalmers 4- by 10-ft. vibrating screen of ¼-in. steel plate with 7/32- by ⅝-in. diagonal slotted openings. This screen is set on a 20 deg. slope and the material passing over it is washed with water at 100 lb. pressure from six fishtail jets with ¼- by 3-in. openings. On the other side of the hopper is a Huron industrial screen with the same-sized openings and set at the same angle. These screens are designed to give a final rinsing to the gravel before it is discharged into the loading bins over the railroad tracks. The undersize and wash water are returned through pipes and launders to the lake.

The arrangement over the loading bins is such that the stone-storage belt may also lead to an auxiliary belt which delivers to a 600-ton wooden storage bin for loading trucks. The auxiliary belt is 30 in. wide, 98 ft. between centers, and rises 30 ft. The sand belt previously mentioned may also discharge to this same auxiliary belt.

There are two bins over the railroad tracks with 55 tons capacity each. These are filled by the sand belt from the washing plant or the stone-storage belt coming from beneath the ground storage for gravel. The material in the bins is discharged to railroad cars underneath through air-operated gates. Cars are loaded on two railroad-type 75-ton Fairbanks scales and the scale man signals the loader by an electric flash when the desired weight is loaded.

An interesting feature of the loading device is a swinging chute beneath the regular chute in the bin. This is a simple steel chute shaped like a grocer's scoop, hinged at the upper end on a vertical shaft allowing a free movement in a horizontal plane and also free movement vertically. When not in use the chute is elevated by a counterweight. It operates in a horizontal plane, thereby distributing the material back and forth across the width of the railroad cars, and thus avoiding segregation of sizes in loading. The chute is moved by a 7½-hp. General Electric induction motor connected through a Falk reducer to an 18-in. steel disk with a pin on an 8-in. radius. This pin is connected to an arm fastened to the lower end of the chute, and as the disc makes 30 r.p.m. it imparts a movement of 16 in. at the rate of 30 swings per minute.

The railroad storage yard consists of a series of spur tracks having a capacity of 70 hopper-type cars on the empty side and 200 cars on the loading side. These cars are manipulated under the loading bins by two Mead-Morrison winch-type car pullers, gear driven by 15-hp. motors. Each car puller is equipped with a double chain and a ⅞-in. cable.

TABLE I. SUMMARY OF OPERATING COSTS

(Dec. 1, 1929, to Dec. 1, 1930. Total sand and gravel loaded during the period: 1,126,169 tons, costs per dry ton of sand and gravel mined)

	Labor	Supervision	Power cost	Fuel cost	Other supplies	Total
Dredging	$0.0147	$0.0015	$0.0260	.....	$0.0051	$0.0473
Transportation, dredge to plant	.0051	.0015	.....	$0.0013	.0016	.0095
Miscellaneous	.0010	.0005	.....	.....	.....	.0015
Crushing, primary	.0020	.....	.0013	.....	.0016	.0049
Crushing, secondary	.0020	.....	.0026	.....	.0021	.0067
Screening and washing	.0060	.0030	.0052	.....	.0023	.0165
Conveying	.0087	.....	.0117	.....	.0015	.0219
Sand flumes	.0020	.....	.....	.....	.0010	.0030
Cleaning and patching cars	.0110	.0015	.....	.....	.0019	.0144
Miscellaneous plant	.0050	.0010	.0052	.....	.....	.0112
Total operating	$0.0575	$0.0090	$0.0520	$0.0013	$0.0171	$0.1369

TABLE II. SUMMARY OF UNIT COSTS OF LABOR, POWDER AND SUPPLIES

(Period Dec. 1, 1929, to Dec. 1, 1930, sand and gravel loaded during period: 1,126,169 short tons)

		Mining	Plant	Other	Total
A. LABOR					
Loading	man hours per ton	0.006	.....	.....	0.006
Transportation	man hours per ton	.....	0.0045*	0.0045	.009
Miscellaneous	man hours per ton	.....	.025	.008†	.033
Supervision	man hours per ton	.0005	.001	.0005	.002
Total labor	man hours per ton	0.0065	0.0305	0.0130	0.050
Average tons per man per shift		.....	.....	.....	104.5
B. POWER SUPPLIES: Total power					
1. Dredges	kw.h. per ton	2.15	.....	.....	.....
2. Pumping	kw.h. per ton	.....	0.212	.....	.....
3. Crushing	kw.h. per ton	.....	.320	.....	.....
4. Screening	kw.h. per ton	.....	.125	.....	.....
5. Conveying	kw.h. per ton	.....	1.098	.....	.....
6. Storage, out	kw.h. per ton	.....	.....	0.45	.....
7. Shops	kw.h. per ton	.....	.....	.02	.....
8. Lighting	kw.h. per ton	.....	.....	.025	.....
Fuel	bbl. of oil per ton	.....	.....	0.0003	.....

*From dredge to dock.
†Millwright, machine shop, etc.

Percentages of Various Sizes of Material Produced

It is practically impossible to state with any degree of accuracy what percentages of the material coming to the plant will pass over or through certain screens. This is because the material as dug is continually changing in character. However, a rough classification of sizes would be about as follows:

	Per cent.
Through primary breaker	1- 0
Over scalper	2- 5
Through vibrator (sand)	40-75
Over vibrator (gravel)	60.25
Over ¾-in. screen	36-15
Under ¾-in. screen	24-10
Over ⅜-in. screen	19- 8
Under ⅜-in. screen	5- 2
Over ¼-in. screen	4- 1.6
Under ¼-in. screen	1- 0.4

This classification shows that out of every 100 tons of material excavated by the dredge, sand represents 40 to 75 tons; plus ¾-in. gravel, 36 to 15 tons; and plus ⅜-in. gravel, 19 to 8 tons. Of the 5 to 2 tons of minus ⅜-in. material screened from the gravel, 4 to 1.6 tons will be plus ¼-in. and balance will be below that size.

An estimate of the proportions of fine and coarse sand produced is almost impossible because of their erratic variation in the deposit, variation in market requirements which control the amount of sand sent to waste and variation of stocks of sand in storage.

Roughly, from 10 to 20% of the total production is marketed as coarse sand and from 2½ to 5% as fine sand.

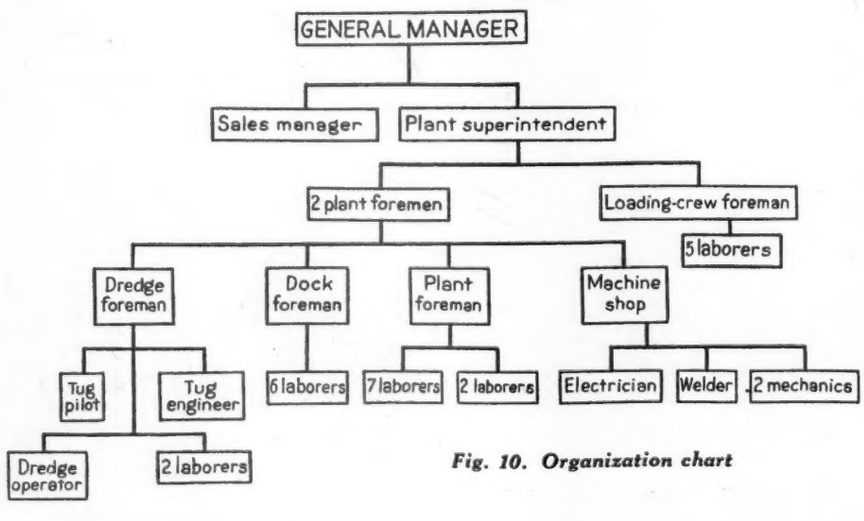


Fig. 10. Organization chart

TABLE III. DETAILED AVERAGE COSTS, OF DREDGE OPERATION

(Period: Dec. 1, 1929, to Dec. 1, 1930. Sand and gravel loaded: 1,126,169 tons)

Dredge operation	Total	Cost per ton
Operating labor:		
Group foreman	$2,400.00	$0.0022
Operator	1,920.00	.0017
Oiler	1,920.00	.0017
Nozzle tender	1,500.00	.0013
Superintendence	.....	.0015
Other operating labor	1,500.00	.0013
Total operating labor	$9,240.00	$0.0097
Power	$29,310.39	$0.0260
Supplies:		
Grease and lubricants	142.88	.0001
Other operating supplies	101.23	.0001
Total supplies	$244.11	$0.0002
Repairs:		
Repair labor	$1,716.41	$0.0015
Shop labor	510.78	.0005
Repair supplies	2,813.43	.0025
General overhauling (labor, material)	7,739.57	.0069
Total repair	$12,780.19	$0.0114
Total dredge operation	$51,574.69	$0.0473

Organization

A chart outlining the organization of personnel is shown on the preceding page.

The plant maintains a safety committee consisting of the plant superintendent, two plant foremen, three group foremen and one electrician. This committee holds monthly meetings for the purpose of discussing accidents and possible steps to prevent similar accidents in the future, or to discuss safety suggestions made by committee members. The committee also periodically instructs employes in the operation of the prone-pressure method of resuscitation, to be used in cases of drowning, electric shock or similar accidents. Various members of the organization have been trained in first aid.

WAGE SCALE

	Monthly wage
Dredge subforeman	$200
Electrician	200
Loading-crew foreman	200
Dredge operator	170
Dock subforeman	170
Plant subforeman	170
	Hourly wages
Welder	$ 0.55
Mechanics	0.55
Tug pilot	0.40
Tug engineer	0.40
Laborers	0.40

Methods and Costs of Mining and Preparing Sand and Gravel at the Clowdy Plant of the Dallas Washed and Screened Gravel Co., Dallas, Tex.*

By Ralph L. Windrow†

General Manager, Dallas Washed and Screened Gravel Co., Dallas, Texas

THE Clowdy deposit was first opened in 1906 and a railroad connection with the Texas and Pacific railway was built in to the deposit in 1917. The present washing and screening plant was built during the latter part of 1927. Prior to this the output was principally pit-run concrete gravel and road gravel, little railroad ballast having been shipped from this deposit.

The Clowdy property consists of about 900 acres on the north side of the Trinity river seven miles west of Dallas. Fig. 1 shows a general layout of the property. The gravel deposits are similar in general type to a number of other deposits of gravel in the Trinity river valley. These deposits vary from fine sand to material containing 70% of gravel above ¼ in. and up to 3 in. The deposits rest on a clay or shale stratum that lies almost horizontal at a depth of from 16 to 22 ft. below the surface. The lower 4 to 8 feet of the gravel at Clowdy are under water and from 4 to 9 ft. are above water. Overlying the gravel is a blanket of red clay and black loam varying from 3 to 12 ft. in thickness. The average depth of overburden at Clowdy is 7 ft. and the average depth of gravel is 12 ft. Gravel deposits occur at various places in the river valley, but are usually within 500 ft. of the present river channel. The Clowdy deposit is, however, about 1½ miles north of the present channel.

The Trinity river is now a silt-bearing stream and has not deposited any gravel in many years, as is shown by the heavy covering of silt over the gravel deposits and the silt deposits along the present channel.

Physical Characteristics of the Deposits

Because the deposits have considerable overburden and the strata of gravel are relatively thin, they are most economically excavated with dragline machines. The presence of water in the lower parts of the deposits prevents the use of power shovels. The deposits are spread over an area large enough for the economical use of standard-gage railroad equipment for transporting the pit-run material to the washing plant.

The sand in this deposit is made up largely of silica, but it also contains a small percentage of limestone. The gravel is largely hard limestone and silica pebbles which have been brought down from the upper river valley. The sand is sharp and well sized; the gravel meets the standard specifications for hardness, strength and shape. The material in this deposit contains but little soft limestone, and to date no trouble has been caused by clay or shale seams. Considerable hard limestone occurs about 100 miles up the river from the Clowdy plant, but none of the limestone ledges in the immediate vicinity of Dallas are hard enough to be used in concrete. The average gravel ranges in size up to 3 in. However, in parts of the deposit there are enough stones larger than 3 in. to warrant the operation of a small crusher at the screening plant.

Most of the gravel at Clowdy is underlaid

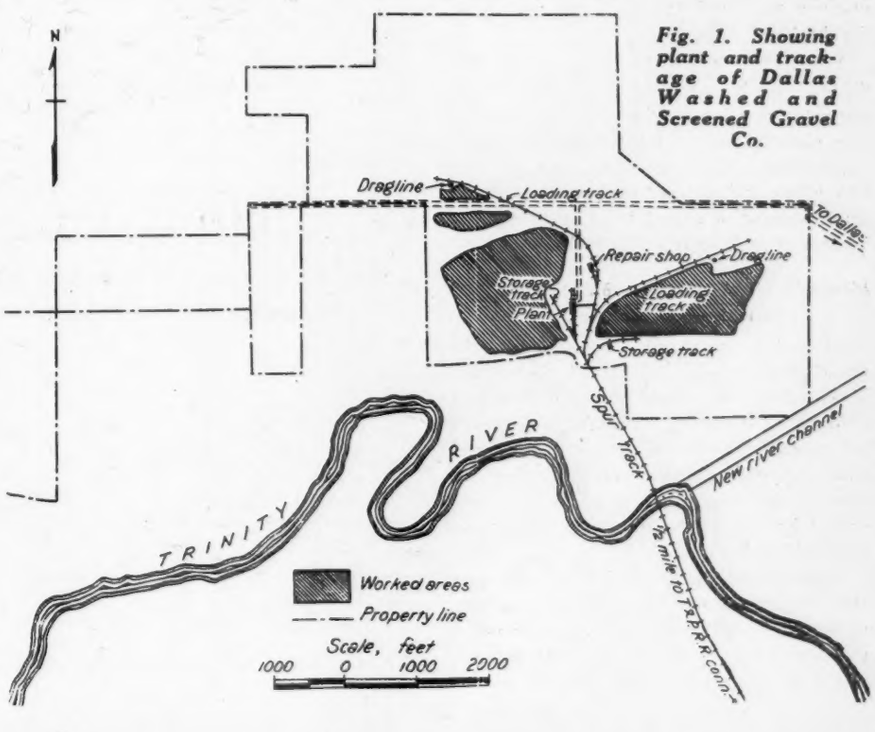


Fig. 1. Showing plant and trackage of Dallas Washed and Screened Gravel Co.

*Abstract of paper presented at the annual convention of the National Sand and Gravel Association, January 27-29, 1932.

†One of the consulting engineers, U. S. Bureau of Mines.

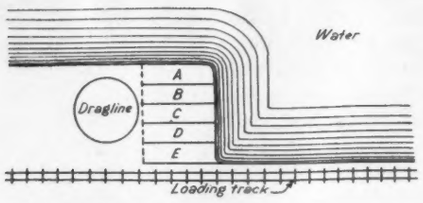


Fig. 2. Illustrating method of mining

by a laminated blue shale that is hard enough to allow the gravel to be removed with dragline buckets without disturbing the shale, provided the operators use ordinary care in excavating.

Methods of Prospecting and Exploration

For preliminary prospecting on this property, holes 300 ft. apart were sunk to water level by using a 6-in. auger with an extension handle made of ¾-in. pipe. Holes up to 20 ft. in depth can be sunk with these augers if water or very sandy material is not encountered. The cost of these holes is about 15c per foot. This type of testing was used only to determine the boundaries of the gravel deposit and the depth of the overburden.

After the gravel deposits were outlined by means of augers, test pits spaced 600 ft. apart were excavated to determine the thickness and quality of the gravel. Some of these pits were dug by hand and some were excavated with a 1-yd. caterpillar-type gasoline dragline crane. The crane would have been used to dig all the pits except for the fact that part of the property is about two miles west of the plant and the time lost in moving the crane to this part of the deposit would have offset the additional expense of digging the holes by hand. Test pits of this type cost about $1 per foot of depth when a machine was used and $1.50 per foot when dug by hand.

Attempts were made to determine the thickness of the gravel on part of the Clowdy property by using a 6-in. well casing and a 5-in. slush bucket to sink through the gravel under water. This method was not satisfactory where the material contained an appreciable amount of gravel larger than 1½ in., because of slow progress in sinking.

Methods of Sampling and Estimation of Tonnage and Values

After the areas and thicknesses of the gravel deposits were determined, the volume of gravel was calculated and converted into tonnage by assuming a weight of 3000 lb. per cu. yd. Screen analyses of the material from various test holes were made and the average percentage of sand and gravel that should be recovered from the property was estimated.

Two methods were used to obtain samples for screen analysis. When test holes were dug with the dragline, the overburden was cast on one side of the hole and the gravel on the opposite side; then an average sample was selected and shoveled into a sack. When test holes were dug by hand, samples were obtained above the water line by removing two shovelfuls of material from the side of the test hole. These samples were taken at regular depth intervals of 3 ft. and all samples from a hole were mixed to obtain the average of the material above the water line. Samples from below the water line were removed from the center of the holes at the same depth intervals. The information obtained from these tests has been valuable in coordinating mining with market requirements, due to the variance in both the quality and size of material in the deposits and the size and grading of material required by customers.

Tests on all of the Trinity river gravel deposits have shown that the thickness of the strata, size and quality of material, and even the color of the gravel and sand change within short distances. The deposits are irregular in shape and change from gravel to sand, clay or loam, in some instances in a distance of 10 ft. or less.

Choice of Method

The considerable tonnage of gravel included in the Clowdy deposit, its location with respect to the market, and the increased demand for washed and graded aggregates warranted the installation of a washing plant. This plant was installed, using Link-Belt equipment, and was so designed that either cars or trucks could be loaded directly from the plant bins. During 1930 about one-third of the material sold was moved by trucks to Dallas or to construction work in Dallas county.

The level ground, the large area of the deposits, and the fact that all pit-run gravel and road gravel for retail shipment could be loaded directly into cars, made standard-gage rail transportation from dragline to washing plant the most economical method of handling the material. Fig. 1 shows the track to the Texas and Pacific railway and the tracks around the plant and to the draglines.

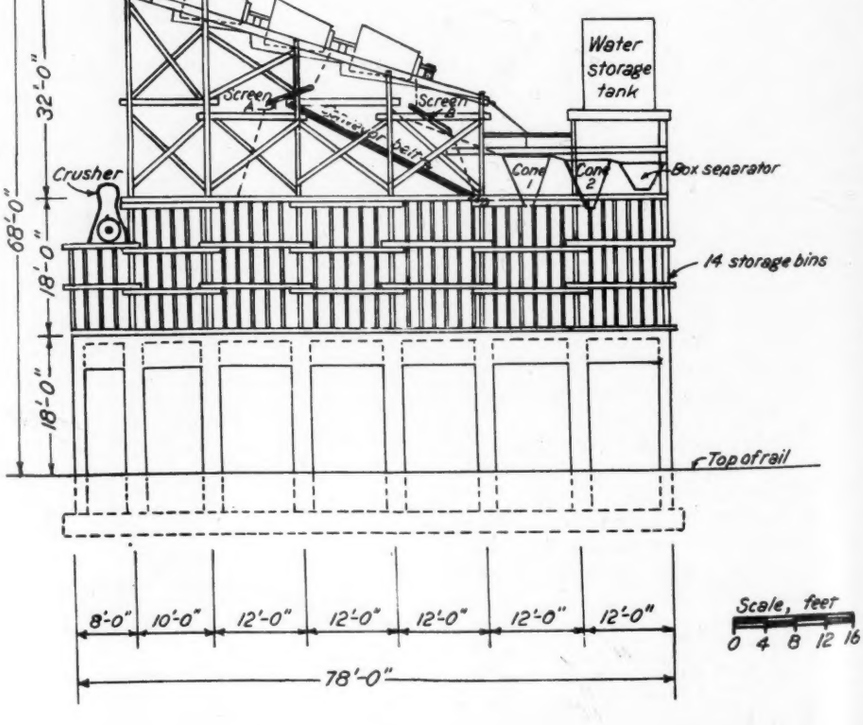
The excavated areas at Clowdy have practically no value and, as there is no sale for the overburden, the economical method of handling it has been to cast it into the excavated pits. This leaves an uneven surface on the worked-over land with high points above the original ground level and low points some 2 or 3 ft. above the shale. These excavated areas are subject to overflow during periods of high water, and the lower parts of the area are always under water, making the land worthless except for use as water storage.

About once a year overflows varying from 1 to 4 ft. above the average elevation of the Clowdy property cause some damage and delay by washing out tracks and depositing mud and driftwood on the tracks and the roads around the plant. The delay to operations varies from one to seven days. Two dams being built on the Trinity river northwest of Ft. Worth and a dam being built on Mountain creek about four miles south of the Clowdy plant will materially reduce the overflow hazard after 1931.

Mining Methods

The overburden is removed from the gravel by the use of dragline machines. During the latter part of 1930 two draglines were in use. One of these machines is a 2-yd.

Fig. 3. West elevation of washing plant



Monighan dragline with a 60-ft. boom and the other is a 3-yd. Bucyrus with a 70-ft. boom. The Monighan machine is driven by a 75-hp. Fairbanks-Morse Diesel engine and the Bucyrus machine is driven by a 100-hp. Diesel engine of the same make. These machines are operated so as to allow one to load gravel into cars while the other removes overburden. At the close of 1930 the machines were located as shown in Fig. 1. The capacity of the two machines exceeds requirements sufficiently to allow time for making minor repairs when necessary. The overburden can be handled at the rate of about 75 cu. yd. per hour for each cubic yard of capacity of the draglines. The fact that each machine removes overburden and excavates gravel in alternating sequence makes the stripping operation interlock with the mining of the gravel.

After the overburden is removed the gravel is loaded into 16-yd. Western automatic-dump cars for transportation to the washing plant. Dragline operators are instructed to load a part of each car with gravel from below the water line and a part from above the water. In order to do this a cut is excavated in sections as shown in Fig. 2. First, all of the material in section A above the water line is loaded, then the material below water in section A is excavated together with the material above the water line in section B. This procedure is carried out in mining all the material in the cut and makes it possible to load dry and wet material together, except when the lower part of section E is excavated. This method of mining keeps the material on the main conveyor belt at the plant dry enough to be conveyed without sliding back on the belt.

The average daily tonnage mined during 1930 was 1030 tons, and the total tonnage was 375,700 tons. The material was divided as follows:

	Tons
Washed gravel	188,000
Washed sand	151,000
Pit-run gravel	31,000
Road gravel	5,700

The wastage at the plant consists of fine sand washed out with the wash water, waste in loading, and some wastage of gravel and sand around the plant. The amount of material wasted at the plant, however, is much less than the waste in the pits, where three types of losses occur as the material is excavated and loaded. Some gravel is picked up and wasted in removing the overburden; some gravel is left under water in the lower part of the excavated area, and there is some loss of material as the cars are loaded. Every effort is being made to prevent excessive waste at the draglines, and it has been found that the amount of the loss depends on the skill of the dragline operators and their co-operation in handling the material.

During the first eight months of 1930 a 2-yd. Monighan Diesel-engine dragline and a 2½-yd. steam dragline were used to excavate the overburden and gravel. In September the steam machine was replaced by a 3-yd. Diesel-engine Bucyrus dragline. All of these machines are full revolving, but all differ as regards traveling mechanism. The steam machine is a skid-and-roller type which moves on 8-in. wooden rollers on 3- by 10-in. plank runways. The machine is moved by placing the bucket in digging position and using it as a deadman, and then pulling the machine forward with the drag cable. This type of traveling equipment is unsatisfactory because it is slow at all times, hard to operate over wet or soft ground, and expensive because about six laborers are required to move the rollers and runways when the machine is moved any considerable distance. The 2-yd. Diesel Monighan is a walker-type machine. This type of traveling mechanism has operated well in our pits. The Bucyrus dragline is a full-caterpillar machine which has proved satisfactory as regards traveling ability where the pit face is 500 ft. or more in length, but the machine has the disadvantage of requiring considerable time and room to make a change of 45 deg. or more in its direction of travel. However, at Clowdy it has the advantage over the Monighan dragline because its operating floor is about 5 ft. higher, thereby making it possible for the operator to see into the cars being loaded. This extra height also helps in casting the overburden away from the gravel to be excavated. The machines now in use both have Diesel engines which burn about 120 gal. of distillate per 24 hours per 100 hp. This distillate cost 4c per gal. in 1930 and was delivered to the plant in tank cars. It is stored in an underground tank from which it is transported to the draglines by wagon.

A dragline crew consists of one operator and one oiler on each shift. The machines are operated almost continuously during the busy season, with shutdowns only when necessary for repairs. During the winter months only one machine is used.

Transportation

Material is moved from the pit to the washing plant in 16-yd. automatic-dump cars pulled by standard-gage locomotives. Two-car trains are used for hauls up to 2000 ft. and three cars are used for longer hauls. The maximum haul to date at the Clowdy plant has been about 3000 ft. and 3-car trains have been sufficient to handle all of the material required to keep the washing plant operating efficiently.

Two locomotives haul all material from the draglines to the plant and from the plant to the main line of the railroad. One of these is a 60-ton American locomotive bought from the Santa Fe railroad, and the other is a 60-ton Baldwin, bought new. They are oil-burning, have six drivers, and a drawbar pull of about 22,000 lb. The work performed by them includes the switching of cars at the plant and the handling of cars that are to be unloaded into storage.

Fig. 1 shows the loading tracks, plant tracks, and the main-line connection with the Texas and Pacific railway. In order to keep the loading tracks moved and relaid, a track crew of one foreman and an average of six men is used. This crew also maintains the main-line tracks. Untreated cull oak ties and 55-lb. rails with standard switches on gravel ballast provide an adequate track. There were only two derailments at the Clowdy plant in 1930 that required more than five hours to rerail the engine and cars. These derailments were on curves and were caused by spreading rails. Most of the derailments resulting in short delays occurred under the washing plant and were caused by waste material falling on the tracks.

The track expense in 1930, excluding depreciation on rails but including all new ties used, was 2.4c per ton of material sold. A total track expense of about $9000 covered the maintenance of four miles of permanent track and the moving and relaying of about four miles of loading track. About one mile of the permanent track is on a fill approximately 8 ft. high and includes a steel bridge across the Trinity river and several other smaller bridges.

The pit-run gravel is unloaded on to a

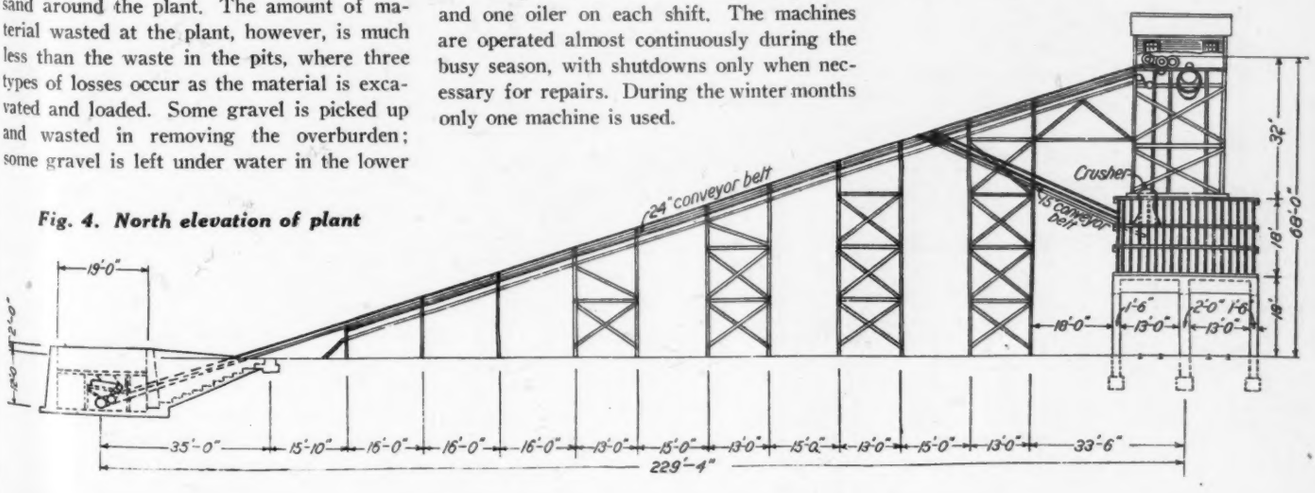


Fig. 4. North elevation of plant

horizontal grizzly made of rails spaced about 6 in. apart over a concrete hopper 19 by 24 ft. in cross section. The material discharges through a 15- by 18-in. opening on to a caterpillar-type belt loader which travels 18 ft. per min. and is 8 ft. from center to center. It is driven by the conveyor belt through two sets of speed-reducing sprockets and chains. The material is loaded on a 24-in. conveyor belt, as shown in Fig. 4, and carried up a 10 deg. incline to the top of the screening plant. This conveyor belt is 250 ft. between centers and is driven 325 ft. per min. by a motor at the top of the plant. When the material leaves the conveyor belt it is deposited in a chute, where water is added from an 8-in. line. The gravel and water are then put through a conical rotating combination scrubber and screen, the screen section of which has 2¾-in. round holes. The oversize on this screen is carried by chute to a small gyratory crusher, the discharge of which is returned to the main conveyor by a 15-in. belt as shown in Fig. 4. This 15-in. conveyor is 61 ft. between centers and is motor-driven at a speed of 175 ft. per min.

The undersize is carried over a conical rotating screen having ¾-in. openings. The oversize on this screen is carried either directly into storage bins below for sale as 2½-in. gravel or is passed over a 4- by 7-ft. Link-Belt vibrator screen on a 30 deg. incline (screen A, Fig. 3), where material above 1-in., 1¼-in. or 1½-in. size can be removed as required. The undersize from the ¾-in. screen is carried to a conical screen having ¼-in. openings. All three conical screens are on one shaft and are driven by a motor at the top of the plant. They are 72 in. in diameter at the top, 36 in. in diameter at the small end, 96 in. long, and make 10 r.p.m. The oversize on the ¼-in. screen is carried to a ½-in. mesh vibrator screen (screen B, Fig. 3), the undersize from which is carried to a secondary vibrating screen with $\frac{5}{16}$-in. openings. The ½- and $\frac{5}{16}$-in. screens are mounted on a 30 deg. slope on a 4- by 7-ft. Diester single-deck vibrator that has been converted into a double-deck vibrator. The oversize on the ½-in. screen is chuted into a bin for sale as ¾-in. gravel, or is conveyed by the belt shown in Fig. 3, to be mixed with gravel from the larger sized screens. This conveyor belt is 24 in. wide, 27 ft. between centers, and travels 147 ft. per min. The oversize on the $\frac{5}{16}$-in. screen is carried into bins for sale as ½-in. gravel, to the sand bins when coarse sand is required, or is conveyed by a short 24-in. belt to be mixed with the larger sized gravel. The undersize through the $\frac{5}{16}$-in. screen is chuted into the coarse-sand bin in such a way as to mix with sand discharged from sand cone 1. The undersize through the ¼-in. conical screen is sent to two 72-in. Link-Belt cone sand separators, then to a box separator where the sand is removed and the water and silt are allowed to overflow into the excavated areas.

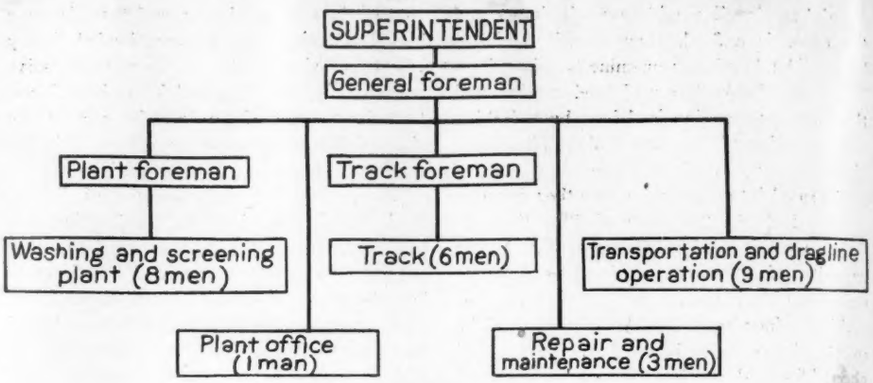


Fig. 6. Organization chart

A complete flow sheet of the plant is shown in Fig. 5.

Based on the output of the plant, the equipment handles about the following percentages of the material:

Machine	Per cent.
Belt loader	100
Main conveyor belt	100
Scrubber and 2¾-in. screen	100
Crusher and crusher conveyor	3
¾-in. screen	100
¼-in. screen	70
0- to 1½-in. vibrator	7
½-in. vibrator	25
$\frac{5}{16}$-in. vibrator	15
Three sand separators	45

The life of the various screens in terms of tonnage handled by each is about as follows:

Size of screen opening	Material	Life, tons
2¾-in.	¼-in. plate	300,000
¾-in.	¼-in. plate	200,000
¼-in.	⅛-in. plate	75,000
1½-in.	¼-in. plate	100,000
½-in.	Woven wire	15,000
$\frac{5}{16}$-in.	Woven wire	10,000

The capacity of the plant is governed by the screen capacity and the quality and size of material encountered in the deposit. The maximum production of washed and screened sand and gravel for a 24-hour period during 1930 was 60 cars or about 3000 tons.

The power used in operating the plant is furnished by the Texas Power and Light Co. through a 3-mile line from a trunk transmission line north of the plant. Three-phase, 11,000-volt current is stepped down to 440-volt current by a transformer bank located at the plant. The plant operation requires an average demand load of 90 hp. to operate the following motors:

1—50-hp. direct-connected motor driving the conical screens and main conveyor belt.
1—35-hp. direct-connected motor driving an 8-in. centrifugal pump that furnishes the wash water.
1—15-hp. motor driving the crusher.
1— 5-hp. motor driving the vibrator screens.
1— 5-hp. motor driving the crusher conveyor.
1—3-hp. motor driving the small conveyor.

Washed sand and gravel for which there

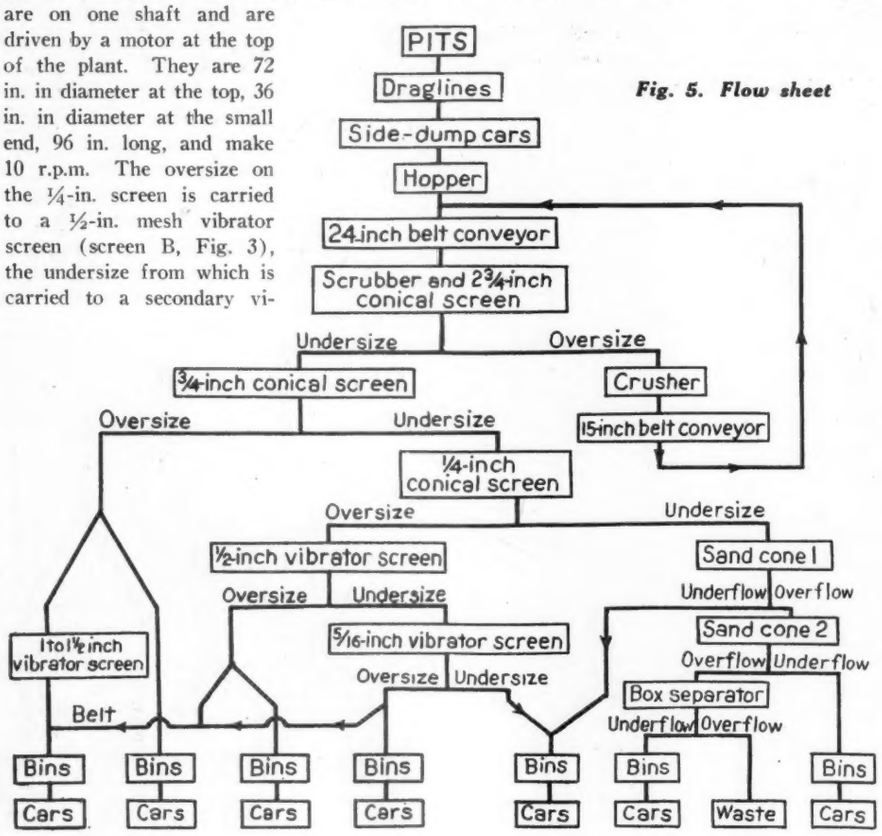


Fig. 5. Flow sheet

SUMMARY OF COSTS, 1930

Material loaded: Overburden, 146,000 cu. yd.; sand and gravel, 375,000 tons

	Operating costs per dry ton of sand and gravel produced					
	Labor	Supervision	Power	Fuel	Supplies, repairs	Total
Stripping (cu. yd. of overburden)	$0.037	$0.007	.....	$0.010	$0.028	$0.082
Stripping	.....	.....	.....	.....	.....	.031
Excavating and loading gravel	.025	.004	.....	.008	.018	.055
Transporting gravel and sand	.026	.007	.....	.027	.011	.071
Track expense	.020	.....	.....	.....	.004	.024
Washing and screening	.057	.009	$0.013	.....	.022	.101
Miscellaneous	.....	.....	.....	.....	.021	.021
Total operating cost*	$0.128	$0.020	$0.013	$0.035	$0.076	$0.303

*Exclusive of depletion and depreciation.

SUMMARY OF COSTS IN UNITS OF LABOR

	Man-hours per ton of sand and gravel					
	Stripping	Mining	Transportation	Track	Supervision	Plant
Washing and screening	.....	.....	.....	.....	.....	0.142
Excavating and loading	0.03	0.05	.....	.....	.....	.....
Transportation	.....	.....	0.057	.....	.....	.....
Track expense	.....	.....	.....	0.06	.....	.....
Supervision	.....	.....	.....	.....	0.004	.....
Total labor per ton (man-hours)						0.343
Average tons per man per shift						32.0
Labor, per cent. of total cost						42.3

is no immediate sale is stored for a few days in cars and then unloaded into storage. The material is handled into and out of storage by a 1-yd. clamshell crawler-type gasoline crane with a 40-ft. boom. Stock piles have been built up along the unloading track, and the material is available for reloading as required.

During the latter part of 1930 a repair shop large enough to house one of the locomotives was built. Major repairs are usually carried on during the winter months.

Water for washing the gravel is pumped from the excavated area near the plant. This source of supply is sufficient except during unusually dry years such as 1930, when it was necessary to pump additional water from the Trinity river. The 8-in. main water supply pump operates at 1800 r.p.m. against a 65-ft. head to furnish approximately 1100 gal. per minute, or about 500 gal. of water per ton of material washed.

Fuel oil for locomotives and distillate for the draglines are bought in car lots and stored in surface tanks till used. During 1930 fuel oil that could be handled without heating was used, but the installation of heating coils in the storage oil tank and the locomotive tenders and the installation of a boiler to heat cars of fuel oil enabled the company to use cheaper and more viscous fuel oil in 1931.

During 1930 the Diesel-engine draglines burned an average of 0.1 gallon of distillate per ton of material handled, at a cost of $.004. The coal-burning steam dragline while in use averaged 10 lb. of coal per ton of material handled. The average cost of this coal was $6 per ton; thus the fuel for the steam dragline cost $0.03 per ton of material handled.

The locomotives in use in 1930 burned an average of 8 bbl. of fuel oil per 11-hr. shift at an average cost of $1.07 per barrel, making a fuel-oil cost of $8.56 per shift. About 1 gal. of locomotive fuel oil costing $.025 was used per ton of material handled.

Organization and Wage Scale

The organization of plant personnel is shown in Fig. 6. Night shifts are supervised by the superintendent and general foreman, with a night foreman in charge. The personnel for the night shift is the same as that for the day shift, except that no track crew is used.

In 1930 the general foreman, foreman, plant-office man, and one mechanic were paid monthly salaries. Machine operators, engineers, plant men, and others employed at the plant were paid an hourly wage. The wage scale paid the employes in 1930 is shown in the following tabulation:

	Number	Rate per hour
Dragline operators	2	$0.65
Dragline oilers	2	.40
Locomotive engineers	2	.60
Switchmen	2	.40
Plant men	3	.40
Plant men	5	.35
Trackmen	6	.30
Mechanic	1	.58
Mechanic's helpers	2	.40
Miscellaneous laborers	2	.35

During 1930 the average working time for crews was 11 hours per day, six days per week.

Sand and Gravel Dredging Methods and Costs of J. K. Davison and Bro., Pittsburgh, Penn.*

By George H. Williamson†

General Superintendent, J. K. Davison and Bro.

THE CORPORATION known as J. K. Davison and Bro. was founded in 1870 by John K. and Edward Davison. Their operations were confined entirely to dredging sand and gravel in the Allegheny river in the vicinity of Pittsburgh. Before the advent of the dredge, sand and gravel were obtained by digging with hand shovels along the shores and on exposed bars and islands. The material was loaded into "flats" or "guipers," which were small open scows generally about 10 ft. wide, 18 in. deep and 30 ft. long, for transportation to the place where it was sold. The "flats" were moved by hand with long poles.

With the advent of concrete construction the demand for sand and gravel became greater, and in 1900 the company bought a steamboat with a ladder, carrying chain and buckets attached to one side. The chain was made of steel links in which two 5/8x3x17-in. bars alternated with one 1½x3x17-in. bar, the buckets being carried on the heavier links. The buckets discharged into a revolving woven-wire screen of a mesh suitable for producing material to meet specifications. The material was washed in passing through the screen, and the gravel was discharged into a flat boat moored on one side of the dredge. The sand was flumed to the other side into a large vat or settling tank, where it was again washed, elevated by a chain of buckets and discharged into another flat boat moored to that side of the dredge. These flat boats were then towed by the dredge, which was a combination tow boat and dredge, to one of the various docks where the material was loaded into cars and wagons.

The flat boats were of wood and were 16 ft. wide, 90 ft. long and 5½ ft. deep, with a capacity of 125 tons each. The first device used to transfer the sand and gravel from the flat boats to a car or wagon was a wooden bucket holding about 1 ton and having a bale to which a derrick line was attached. The bucket had a hinged bottom held fast by a catch which was loosened to empty it. These buckets were filled by crews of men using shovels.

With the advent of clamshell buckets and modern steel-hopper and flush-deck barges, these old methods were discarded. Modern steel derricks have taken the place of the wooden stiff-leg and mast type. They are operated by large 3-drum steam engines and have buckets of from 3 to 5 tons capacity. These hoists will load a 70-ton railroad car in about 15 minutes. The barges now used are built of steel and are of two types.

The hopper type, which is illustrated in Fig. 1, is 135 ft. long, 26 ft. wide and 10 ft. deep. The inside or cargo space is hopper-shaped, which causes the material to run to

*Abstract of paper presented at the annual convention of the National Sand and Gravel Association, January 27-29, 1932.

†One of the consulting engineers, U. S. Bureau of Mines.

the constricted bottom area when being unloaded. This tends to decrease the unloading time by 25% as compared with the flush-deck type of barge which is of the same size but has solid decks on which the cargo is held within a 40-in. box or bulkhead. In the latter type the whole load is carried above deck; natural drainage is thus provided for the load, but the barge becomes top-heavy. The hopper-type barge is more stable and seaworthy, as well as easier and quicker to unload, but it has the disadvantage of delivering wet material. Both types are used advantageously under various conditions.

Landing docks and storage yards are maintained at five places along the river. At Tenth St. in Pittsburgh a modern electric hoist with a 3-ton bucket unloads the sand and gravel from the barges and places it in steel bins in which the numerous sizes necessary to meet the specifications of the various users are separated by partitions. These bins are elevated to permit trucks to pass under them and load by gravity. They have a total capacity of 2200 tons. At Thirtieth St., Pittsburgh, there are similar facilities except that the unloading hoist is steam powered. At this plant there is a railroad connection, enabling the company to load about 20 cars per day. There are also storage bins of the same style and size as at the Tenth St. plant for loading motor trucks. The hoist here will handle 1800 to 2000 tons in 10 hours.

Another plant located at Coleman, Penn., has a steam hoist with a 5-ton bucket which will load 2800 to 3000 tons into cars in a 10-hour day. A plant located at New Kensington, Penn., is equipped with two steam hoists with clamshell buckets of 3-tons capacity each, which load into railroad cars, bins for truck loading or stockpiles. These storage piles have contained 100,000 tons of sand and gravel. A steam locomotive crane with a 3-ton bucket moves around this yard and shifts material as required. At Aspinwall, Penn., there is a car-loading plant equipped with a steam hoist with a capacity of 1000 tons per day.

The company operates a fleet of 48 steel barges, of the types referred to, having a capacity of 600 tons each. These are towed from the dredge to the various unloading docks by two steam tow boats. The company has operated exclusively in the Allegheny river, starting in the immediate vicinity of Pittsburgh. As operations continued and the river was improved by the government with locks and dams, the equipment was gradually moved upstream to a point 35 miles above the mouth of the river. The tows now pass through five locks, making a round trip in from 24 to 30 hours. A boat will usually tow seven barges. Each tow therefore contains about 3500 to 4000 tons of sand and gravel. The tows are too long to pass through locks at one time and are put through in two sections.

Geology

The sands of the Allegheny and Ohio rivers are sharp and hard, whereas those of the Monongahela are soft and round-grained, the difference being due to the source of the parent material. The sand of the Allegheny and Ohio rivers originated in the igneous rocks of Canada, but the softer Monongahela sands came from the sedimentary rocks in its drainage area. The Allegheny gravels likewise came partly from Canadian rocks. The pebbles and boulders are well rounded and constitute the most conspicuous part of the deposit, the gravel being made up largely of pebbles of sandstone, quartz, chert and igneous rocks. The deposits vary from shallow bars to accumulations 60 to 70 ft. thick. There is little clay in these deposits, which evidently were left in the bed of a swift-moving stream or glacial torrent, the velocity of the current being too great to allow the deposition of clay or fine sand. Therefore, what clay is encountered has been brought down from the upper reaches of the river in recent times. Early workings have been filled with clay and debris from upstream.

The dredge can only dig to a depth of 60 ft.; hence it is sometimes necessary to move it and abandon good gravel without reaching the bottom of the deposit. The workable deposits vary greatly as to the ratio of sand to gravel. In places there is apparently no sand, the whole floor of the river being a mass of pebbles and boulders. In other spots sand has filled the voids in the gravel.

Modern conditions have hampered dredging operations somewhat as large quantities of sewage and other debris have come into the river and rendered much of the sand and gravel useless. The small streams and sewers during flood times discharge leaves, mud, ashes and other material which also contaminate the deposits. On an average, dredging operations produce roughly 30% of sand (material finer than ⅜-in. mesh) and 70% of gravel.

Prospecting has been confined to actual digging by spotting the dredge at certain points, and if the material after being dredged and screened is found satisfactory, operations are continued until the supply is exhausted or until the equipment must be moved because of river or weather conditions.

River sand and gravel are generally not tested until they have been screened, washed and otherwise prepared to meet the specifications of various users. The only method of pre-sampling is what is commonly termed "sight analysis." The dredge is moved to a spot thought to contain gravel and actually digs, washes and sorts the material. The dredge operators compare the material dug with the material produced by the washing and screening machinery, and a screen analysis is made of the finished material to determine what specifications it will meet.

The great preponderance of coarse to large bowlders, the scarcity of sand and the depth of the deposits, caused the company to adopt the ladder-type bucket dredge as the most economical, but because of the many rounded bowlders in the deposits, the bucket chain was constructed as a loose belt rather than the usual comparatively tight one employed on this type of dredge. The slack chain allows the buckets to drag along the river bottom and gives them more time to fill.

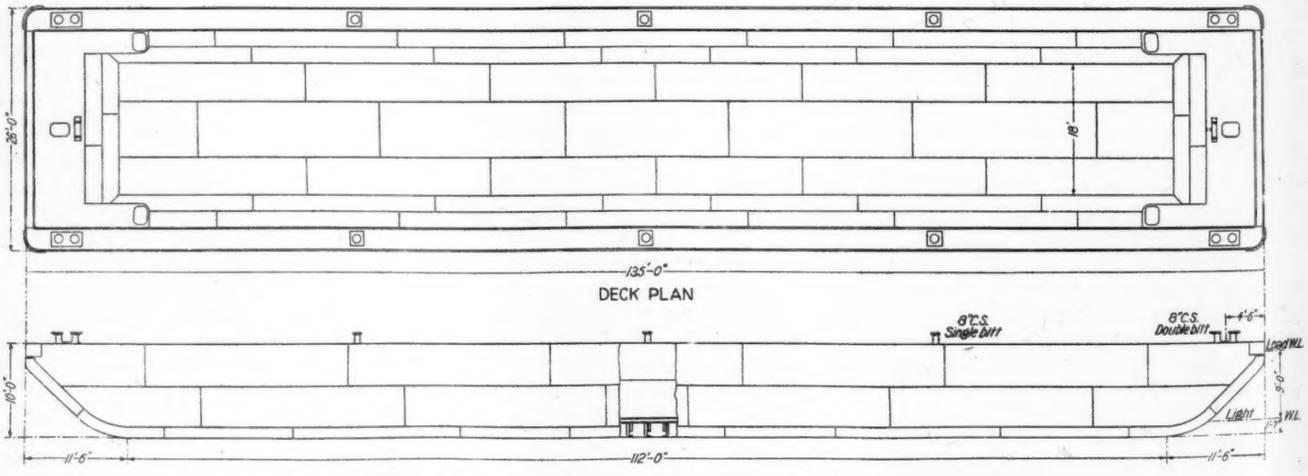


Fig. 1. Plan and elevation of hopper-type barges of J. K. Davison and Bro.

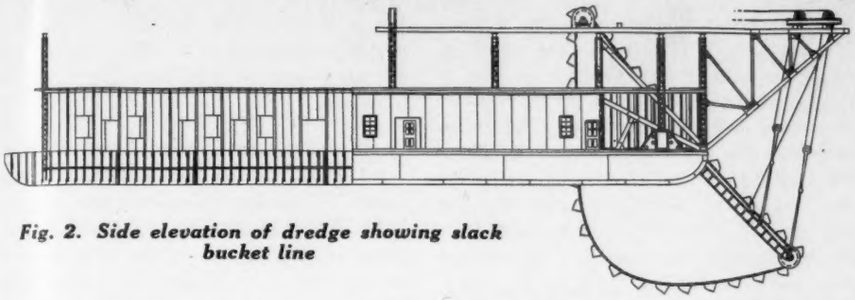


Fig. 2. Side elevation of dredge showing slack bucket line

Fig. 2 shows the slack character of the bucket chain.

Mining

The dredge *Allegheny* was built from local designs which were evolved from experiences with the previous bucket-chain dredge. The link feature of the chain was retained, as was also the slack bucket chain differentiating it from the ordinary type of ladder dredges. Figs. 3 and 4 show the deck plan and elevation of the dredge, which was built in 1920 and is constructed entirely of steel. The hull is 45 ft. wide, 7½ ft. deep and 165 ft. long, with bow gantry extending 35 ft. The ladder carrying the bucket line moves up and down in a well which extends 59 ft. into the hull and is 7½ ft. wide. The ladder fits this well closely and is hinged to structural steel supports from bearings on a 7-in. shaft. It is raised and lowered by wire rope and a single-drum hoist driven by an 80-hp. motor. The average life of the cable is 18 months.

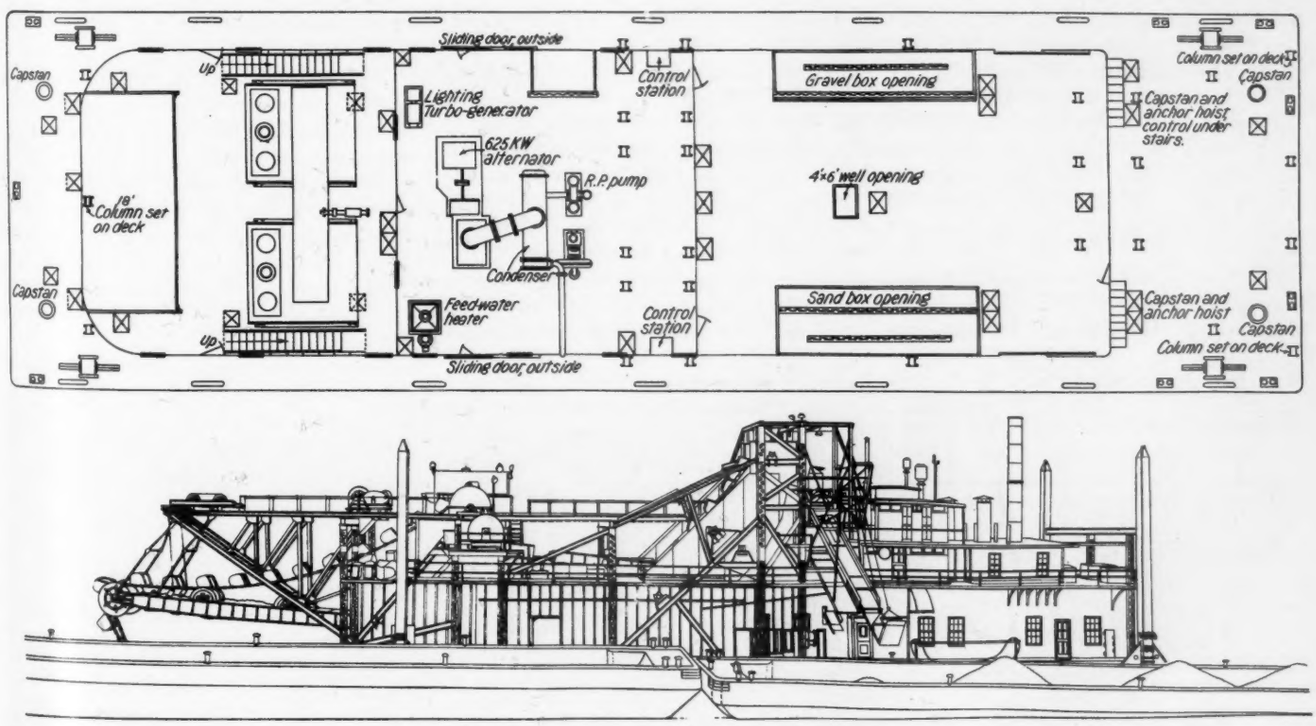
The ladder is 52 ft. from center to center of its sheaves. The bucket line extends above the ladder to an upper sheave supported on the dredge itself; which sheave drives the bucket line. There are no supports for the bucket line between the point where it leaves the ladder and the upper sheave, a distance of 25 ft. This makes a total distance of 77 ft. from center to center of the upper and lower sheaves and results in what is technically termed a "flexible ladder." The weight of the ladder is 15 tons, but the weight of the ladder, buckets and chain is 65 tons.

The bucket chain is made of a double row of cast manganese-steel bars consisting of one solid link, one inside strap link, and one outside strap link, all being held together with a soft-steel bolt 1½ in. in diameter and 8 in. long, passing through a manganese-steel bushing which takes the wear. On the inside end of each bolt under the nut is a steel washer ¾ in. thick and 6 in. in diameter, which holds the bushing in place. The nut is tightened and the thread end is heated and burred down, making a secure joint in the chain which does not come apart. Until this plan was followed, considerable trouble was experienced with bolts coming loose and thus breaking the chain. The links wear from two to three years, with changes of bushings from time to time.

There are 33 buckets in the chain, each with a capacity of 21 cu. ft. They are made of sheet steel with cast manganese-steel heads and lips, the latter securely riveted to the cutting side of the buckets. Each bucket is attached to the chain at every fourth link by a bracket, cast integrally with the head and fitting into the chain like a link. The bucket line works with a large loop hanging under the ladder and is capable of reaching 55 to 60 ft. below water level. The buckets upon being filled are carried over the 60-in. diam. sheave on the ladder to a 60-in. diam. sprocket sheave mounted on a special heat-treated shaft 10¼ in. in diameter on the superstructure of the dredge. This sprocket sheave is driven through a series of gears by a 250-hp., variable-speed motor. The buckets dump into a pan lined with manganese-steel plates. Streams of fresh water play on both sides of the pan and break up the material as it is delivered by the buckets. It then passes into two trommels 5 ft. 8 in. in diameter and 38 ft. 6 in. long, over all.

The trommels each have an inner shell of ⅝-in. steel plates with 4½-in. round holes. The sizing screens are riveted or bolted to the inside of these shells. Extension brackets on the outside of the shells carry the sand jackets. The trommels revolve on manganese-steel tires and are driven through gears and countershafting by a 75-hp. motor. The trommel rolls freely on the trunnions, deriving its impetus by friction between the tire and the trunnions. All trunnions have roller bearings, which usually serve one season. The trommels are set at a slope of ¼ in. to the foot and make 8 r.p.m.

A trunnion made from a commercial grade of cast steel gave good service while being



Figs. 3 and 4. Deck plan and side view of dredge

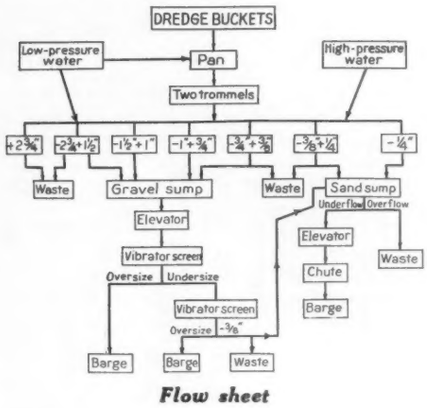
tried out during the last season, and is thought to be more satisfactory than the manganese-steel trunnions because it can be machined. Two tires made of rolled steel to which has been shrunk a wearing tire such as is used on locomotives are ready to be installed. It is hoped that these tires will give better service than the manganese-steel tires, which do not keep a true surface. Further, after service the rolled-steel tires can be machined to a true circle and can be removed and replaced by new tires as becomes necessary. It is important that the trunnions and tires be carefully lined up, as this results in longer wear of the bearings and thrust rolls.

The sizing screens are fastened inside the trommel frame with countersunk bolts. The first 2 ft. of the trommel consists of a cylinder of unperforated steel plate on which the upper tire is mounted. This acts as the wearing plate against which the material impinges as it enters the trommel. The next 12 ft. is made up of steel plate with 1-in. square punched holes. This passes the fine gravel and sand to the sand jackets. The next 18½ ft. has 1½-in. square punched holes. The following 3 ft. is of unperforated steel plate which supports the lower tire. This in turn is followed by another 3-ft. section of plate, usually with 2¾-in. square holes, but so arranged that the screen can be easily removed and replaced by one with holes of different size, depending on market requirements for coarse gravel.

The first 15 ft. of the sand jacket is covered with 4-mesh wire screen. The next 3 ft. has ⅜-in. mesh and the lower 3 ft. ¾-in. mesh wire screen.

Suspended at each end but running through the center of the trommel is a 4-in. water pipe perforated with ⅜-in. round holes 3 in. apart. This pipe is in two lengths which are joined by steel flanges between which there is a solid plate. This plate divides the pipe into two independent parts. The upper pipe supplies water in large volume but at low pressure to the incoming material while the lower pipe supplies less water but at high pressure to assure the removal of all clay from the gravel.

The function of the 1-in. screen is to protect the sand jackets from excessive wear by bypassing the heavier gravel. The undersize from the ¼-in. sand screen passes through a chute to a steel hopper. The undersize from the ⅜-in. screen also can be sent to this hopper or it may go to the tailing well, where it is wasted to the river. The undersize from the ¾-in. sand screen on one of the trommels is sent directly to the tailing well and wasted. Similar material from the second trommel can be chuted to waste or to the gravel sump as desired. The oversize from the ¾-in. sand screen joins the undersize from the 1½-in. screens and goes to the gravel sump. The oversize on the 1½-in. screens can be sent to the tailing well and rejected as waste or sent to the gravel sump at will. All oversize above 2¾-in. is sent to waste through the tailing well.



Flow sheet

The minus ¼-in. material is sold as fine or masons' sand, and the minus ⅜-in. material is used in concrete. The undersize from the ¾-in. screen is usually sent to waste, but is sometimes saved for light concrete work such as concrete pipe, etc.

Sand from the jackets falls to the sand sump and is picked up by a line of buckets similar to the main dredging line, except that the chain is of lighter construction and the buckets have a capacity of 11 cu. ft. This line of buckets passes over a sprocket and is driven through a worm gearing of steel and bronze by a 75-hp., variable-speed motor. The elevator discharges 12 to 14 buckets per minute and the sand is then chuted over the side of the dredge to a barge.

The gravel passes from the trommel into a chute to a hopper or sump on the opposite side of the dredge, where it is rewashed and elevated with a bucket line similar to the sand elevator but discharging 11½ to 14 buckets per minute.

The gravel elevator discharges to two single-deck 4-ft. by 6-ft. vibrating screens set at an angle of 38 deg. This angle may, however, be changed as needed; and as the volume of material being screened increases, the angle of the screen must be steepened. Screens with mesh opening varying from ½ to 2¾ in. are used here, depending entirely on requirements of the order being filled. The capacity of the vibrators is roughly 200 tons per hour.

All gravel from the sump passes directly to the first vibrator, the oversize from which is chuted to a barge alongside the dredge. The undersize passes to the second vibrator, which is always equipped with a ⅜-in. mesh screen. The oversize from this screen passes through chutes to a second barge, and the undersize goes to waste or to the sand sump, as desired.

Water Supply

Wash water for the dredge is furnished by three single-stage centrifugal pumps. Two of these supply water to the pan which receives the material from the dredge buckets, and to the upper ends of the two trommels. They are 10-in. pumps direct-connected to 25-hp., variable-speed motors and delivering 2000 gal. per min. each. The third is an 8-in. pump which delivers 2000 gal. per min. at a pressure of 45 lb. per sq. in. This pump is direct-connected to a 100-hp. motor and delivers water to the lower ends of the trommels.

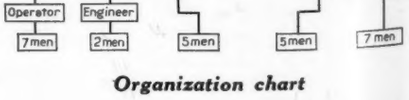
Miscellaneous Dredge Equipment

Wherever possible, chutes are lined with rubber of varying thicknesses, as follows: ¼ in. in the sand chutes, ½ in. in the fine-gravel chutes, ¾ in. in the coarse-gravel chutes, and 1 in. in the heavier-gravel chutes. The chutes are pitched at an angle of 33 deg. to insure a steady flow of the material. The rubber is all bolted to the chutes, the bolts running through steel straps which are covered with vulcanized rubber ⅜ in. thick. These straps are placed in the corners of the chutes. The rubber linings give from five to ten times as much wear as steel. The sides of the dump pan and the tailing wells are lined with worn solid truck tires. A 15-in. section is cut from these tires and then they are flattened by passing them through rolls. These tires give ten times the wear of steel.

The dredge is held in place by spuds at each corner of the boat. These spuds are 24 in. square and 60 ft. long. They are of fir timber and have an 8 by 8 in. steel angle riveted securely on each corner. A cast-steel point is fitted on the lower end. The spuds are raised and lowered by a 15-hp. motor. The dredge is moved in the cut by manila ropes attached to tie posts ashore and has no motive power of its own, being moved from place to place by a towboat. The power plant consists of two horizontal Heinie water-tube boilers of 300-hp. capacity each, which furnish steam at a pressure of 160 lb. to a 500-kw. turbine generator set which furnishes 220-volt direct current to the various motors. An auxiliary turbine set of 50-kw. capacity supplies current when the large plant is shut down.

The plant consumes 12 tons of coal each 24 hours. However, all of this is not used to furnish electric power. Large quantities of steam are used in supplying power to the syphon pumps for dewatering barges, for heating purposes, and especially in winter for thawing frozen material and equipment. The average cost of producing power on this dredge is 7½ mills per kw.h. A 2-drum hoist is provided to move the barges alongside the dredge.

Safety devices such as gear covers, handrails and walk ways are provided for the crew, and all safety rules and regulations are observed. Oxyacetylene welding and cutting equipment is used extensively and this facility enables the crew to do much work without outside help. All riveting equipment is also provided.



Organization chart

TABLE I. SUMMARY OF OPERATING COSTS OF DREDGE "ALLEGHENY," 1930
(Total material loaded, 735,000 tons of sand and gravel)

	Costs per dry ton sand and gravel mined				
	Labor	Supervision	Fuel	Other supplies	Total
Dredging	$0.0610	$0.0420	$0.0085	$0.0724	$0.1839
Transportation	.0671	.0491	.0079	.0538	.1779
Total	$0.1281	$0.0911	$0.0164	$0.1262	$0.3618
Depreciation					.1225
Total operating cost					$0.4843

Size Ratio of Raw Material

Because of the variable character of the material in the gravel bars it is impossible to state with accuracy what percentage of the total production will be represented by any particular screen size. However, a rough analysis is as follows:

Of 100 tons of material dredged:

25 tons will pass ¼-in. mesh.
5 tons will pass ⅜-in. mesh, but will be retained on ¼-in. mesh.
20 tons will pass ¾-in. mesh, but will be retained on ⅜-in. mesh.
25 tons will pass 1½-in. mesh, but will be retained on ¾-in. mesh.
15 tons will pass 2¾-in. mesh, but will be retained on 1½-in. mesh.
10 tons will be retained on 2¾-in. mesh.

Life of Screens

The approximate life of screen plates under normal operating conditions is as follows:

¼-in. trommel screen—300 hr.
⅜-in. trommel screen—700 hr.
¾-in. trommel screen—1700 hr.
1- in. trommel plate—1 year.
1½-in. trommel plate—6 mo.
2¾-in. trommel plate—4 mo.
Vibrator screens—300 hr.

Approximately 50% of the material dredged is wasted; this consists of the pea gravel, some of the plus 1½- minus 2¾-in. gravel, and nearly all of the plus 2¾-in. gravel. Plans are now being made for crushing this oversize material and eliminating this waste in the future. Approximately 30% of the material dredged is saved as gravel, and about 20% is saved as sand.

Living quarters are provided for a crew of 22 people, consisting of the following:

1 chief operator.
2 assistant operators.
1 chief engineer.
1 assistant engineer.
8 deck hands.
2 firemen.
2 coal passers.
2 oilers.
2 cooks.
1 handy man.

With this crew the dredge operates 24 hours per day, six days per week. All modern facilities, such as filtered water, electric refrigeration, bathrooms with hot and cold running water, electric lights, etc., are provided. Salaries and wages include board, and no bonus or contract rates are employed.

Description of Towboats

The towboats are constructed of wood and are 125 ft. long, 25 ft. wide and 4½ ft. deep.

TABLE II. SUMMARY OF COSTS IN UNITS OF LABOR AND POWER, 1930
(Total material loaded, 735,000 tons of sand and gravel)

Labor, man-hours per ton:		
Dredging	0.0993	
Transportation	.0876	
Total labor	0.1869	
Average, tons per man per shift		53.5
Labor, percentage of total cost		26.4
Power, kilowatt-hours per ton:		
Dredging ladder	1.11	
Pumping	.60	
Screening	.30	
Elevatitng	.40	
Total	2.41	
Fuel, tons of coal per ton of sand and gravel		0.0099

They are equipped with the "western-rivers" type boilers.

Each boat uses about 15 tons of coal in 24 hours, which furnish steam at 225 lb. to two high-pressure engines turning a paddle wheel about 25 r.p.m. and developing approximately 300 hp. These boats have cabins and sleeping quarters for the crew and modern facilities such as electric refrigerators, electric lights and distilled and filtered water. Powerful searchlights are provided to enable the pilot to see at night. Steam steering gear is provided to operate the tiller and rudders. The crew of each of these towboats consists of the following members:

1 master and pilot.
1 chief engineer.
1 mate.
1 watchman.
1 fireman.
2 deck hands.
1 steward.

When the boat operates 24 hours per day another crew of the same size takes a 12-hour watch.

Discussion of Operation

The chief issue in the discussion which followed the foregoing papers on the operation and cost of sand and gravel production centered on the relative efficiencies of pump dredging and the Ward jet method.

A discussion presented by **R. C. Collins** of the Standard Building Materials Co., St. Louis, Mo., described in detail this company's 20-in. Morris pump dredge, powered with an 840-hp. Fairbanks-Morse Diesel engine (the dredge was described in Rock Products recently). This dredge under test produced 1000 tons of sand and gravel per hour with 650 hp., which Mr. Collins compared with 1400 tons per hour, at an expenditure of 2300 hp. for the Ward jet system. On this basis the power cost of operating the pump dredge was 0.48c against 1.24c per k.w.h., with electricity at 1c per k.w.h.

It developed in the discussion that while the Ward dredge carries 2300 hp. of connected motors, only 1175 hp. are used in the operation of the dredge, because while the dredge is supplied with two jets, only one is used at a time; the other one being a standby unit.

So apparently the cost comparison made by Mr. Collins would be something like 0.6c for the Ward system against 0.48c for the pump.

Pierce J. McAuliffe (Morris Machine Works) took issue with the statement in Mr. Ward's paper that a pump dredge would not work beyond a depth of 50 or 60 ft. below water level, and gave an instance of a 10-in. pump handling mine tailings from a depth of 110 ft. below water level. He questioned Mr. Ward's figures on power saving, stating that the comparative figures were evidently based on delivery through long pipe lines and not on conditions commonly found in river dredging operations where the material is pumped into a barge alongside the dredge.

Mr. McAuliffe also questioned the 46% solids mentioned in the Ward paper, stating that this took into account only the water pump through the jets and did not take into account the amount of water drawn into the suction with the solids, which undoubtedly was very considerable.

In the discussion of J. K. Davison & Bro. Co.'s dredge operation, interesting facts were brought out in connection with the use of the Hum-mer screens to dewater the gravel and save pumping out the hopper bottom barges, which was formerly quite an item of expense.

Experience with Rubber Chute Lining

Another point brought out in the discussion was experience with rubber lining for chute or launders. Mr. Williamson stated that he had excellent results with rubber lining but on the long gravel loading chute where the slope was less than 30 deg. he had found that gravel would not slide over rubber in its dewatered condition and rather than add water to make it flow, after having taken the trouble to dewater it, they used a steel lined chute. He stated that 30 deg. was about the minimum slope that could be used for a gravel chute lined with rubber.

Frank A. Bingham (Northern Gravel Co., West Bend, Wis.) stated that at his plant in Wisconsin, rubber linings were used not only in chutes but in the surge

bin and other parts of the plant and that his experience was that rubber had five times the life of steel; the cost for ½-in. rubber lining being about three times the cost of steel; so that there was real economy in the use of rubber. The launders at this plant are made of 2-in. plank and the rubber is merely nailed to them. One advantage of rubber is that worn places may be replaced or patched without difficulty.

A good deal of the rest of the discussion had to do with the reasons why ladder dredges were used exclusively in the Pittsburgh district instead of pump dredges with Swintek ladder nozzles. It was brought out that dredging in the Allegheny and Ohio rivers encountered very hard bottom and that while suction dredges have been tried at various times they could not be made to serve efficiently. It was brought out, however, that there was reason to believe that with a modern "Swintek" nozzle and modern efficient dredge pumps, it might be feasible and possible to dredge these rivers.

Competitive Conditions

A number of the papers and discussions at the convention had to do with competitive conditions in the industry, particularly with the competition of local or temporary pits.

J. W. Kelly, for several months a field representative for the National Sand and Gravel Association in Minnesota and neighboring states, specially studied these conditions and reported on them as follows:

The production of concrete aggregates for state highway paving from temporarily operated deposits located near enough to the job to avoid railroad shipment of aggregates has been an increasing practice in recent years. These sources of supply are called variously "roadside pits," "wayside pits," "local pits" and "portable plant pits." The term "local pit" is used here to designate one which is developed for one or two jobs, with a portable or temporary washing and screening plant.

In many locations, such as those in districts outlying from established centers of production, such plants appear to be the logical solution to the problem of obtaining a satisfactory pavement at minimum cost. In other locations, particularly at the marginal shipping distance of plants located permanently at large deposits, the serious question may be raised as to the real economy of local production. Many established producers feel, moreover, that local plants are not capable of turning out the same quality of product as the larger plants, but that inspection is sometimes relaxed in order to encourage their use.

Representative Stationed in Minnesota

In order to get first-hand information on this problem, which is obviously of importance to the entire sand and gravel industry, the National Sand and Gravel Association cooperated with its local membership in stationing a representative in Minnesota for the major part of the construction season of 1931. His duties, so far as state highway paving was concerned, were to cooperate with the highway department in seeing that all aggregate supplies were satisfactory, and particularly to observe the set-up and the product of local and portable aggregate plants with a view to determining their proper field in the aggregate industry; this arrangement was satisfactory to the highway department, and their engineer of tests and inspection gave excellent cooperation throughout the season. About 30 paving jobs and 40 aggregate plants in Minnesota, Wisconsin and Iowa were visited and conferences were held with producers, contractors, engineers of the state highway department and of the U. S. Bureau of Public Roads, and others connected with paving work. This report covers observations with reference to state highway paving work only.

Plant Classification and Production

The Minnesota paving program for 1931 (lettings previous to August 15) comprised about 420 miles or 4,935,000 sq. yd. of concrete, using about 1,690,000 tons of aggregate. Of this, about 39% was sand, 57% gravel and 4% crushed limestone. The work was let in 28 projects, continuous sections ranging from 4.3 to 26.5 miles in length and averaging 15 miles. Aggregates were furnished from 20 plants, of which 14 may be classified as permanent and 6 as local or portable. The six portable plants (30% of the plants) produced about 24% of the total tonnage. Shipped material traveled on an average of about 65 miles, carrying a published shipping rate of 70c per ton. Two of the portable plants shipped their material by rail, an average distance of about 40 miles. This latter constituted about 8% of the ton-mileage for the state. These figures given are approximate, but are essentially correct in that greater refinement would not substantially alter the stated relations.

Indications as to Relative Costs

Distance is a prime factor in aggregate prices, as the freight often equals or exceeds the cost of the material itself. An attempt was made to study the distance advantage of local pits by noting the location of jobs served by them with respect to the nearest commercial plants. Not enough direct information was available to formulate conclusions. Reliable sources, however, indicate that the price quoted for local pit aggregate is based on an estimate of the cost of commercial production (which is fairly well established) plus the established freight rate, being made lower by a small margin. While it is difficult to estimate the cost of local-pit production in advance, it is generally recognized that this is considerably higher than from commercial plants, distance and rates being the determining factor in sales.

Trend of Paving Farther from Twin Cities

The average distance (air line) of the centers of paving jobs from the Twin Cities in 1931 is about 120 miles, while the same dimension for the program expected in 1932 is about 140 miles, based on about the same mileage of paving. Even with discounts for the roughness of the estimate, it is evident that competitive conditions will be more favorable toward local-pit production. However, in view of the general practice in other states of widening existing highways and increasing the cross connections near large population centers, it would seem that a balanced program could properly include a considerable yardage near the Twin Cities. Other things being equal, scattering the construction work well enough to keep established plants occupied should secure for the state more favorable prices than if operations were intermittent, and the year's aggregate production were made to depend almost entirely upon outlying plants.

Relative Quality of Product

It may be asked, how does the product of local pits compare with that from permanent or commercial plants? With the state highway specification in mind as a basis of comparison, careful visual inspection was made, and in many cases state highway inspection records (field and laboratory) were consulted. The most definite comparison was made by taking a cross-section of the reports on routine weekly samples which were sent to the central laboratory by highway inspectors. Like the personal observations, the tabulation fails to disclose any significant difference. In several cases materials were observed to deviate from the standard requirements in one particular, but the deviations were of a minor nature, and conditions were promptly corrected.

It should be emphasized, however, that with respect to the sufficiency and condition of plant equipment, the representative was informed that the water supply and screening area of several plants (local and permanent) had been improved since the previous year's operation. In general, the existing plants, both permanent and local, were in satisfactory condition as regards these important items of water supply and screen capacity, provided reasonable production rates were not exceeded.

State System of Inspection

Some features regarding inspection became evident, all tending to favor the acceptance of doubtful material at local plants. Aggre-

gates which are shipped by rail are subject to double inspection, being tested for cleanness and quality at the plant and examined visually at the batcher. Aggregates from a pit which is located alongside the job are inspected only at the plant, and then are stockpiled and batched into the concrete a short time later (usually one day). In doubtful or border-line cases, the plant inspector at a "shipping" plant is more likely to reject, since he is apprehensive of a rejection at the job end of the shipment, which would bring about a reprimand.

In the second case, the plant inspector knows that the material (assuming he decided to pass doubtful material) will soon be covered up; hence he is more likely to be lenient. Moreover, the second inspector generally lives with the plant crew, and is likely to be on a more friendly footing, and less likely to reject in border-line cases. Another factor is, that the average man will hesitate longer before rejecting a stockpile (several carloads) than a carload, which is a relatively small unit.

The association representative pointed out these features to the engineer of tests and inspection and, to equalize matters, urged that the traveling inspector-instructor devote relatively more attention to those plants which were under single inspection, and that another traveling inspector be provided.

As happens in all construction projects of the size and variety of a Minnesota paving season, a number of aggregate rejections were made. In *number* these were chiefly from commercial plants; in *quantity* of output they were approximate in proportion to the outputs of the permanent and local plants. In most cases rejections were routine and were not protested by aggregate producers. Some matters in which inspection seemed most difficult of enforcement were: mixing product of two or more plants shipping to one job; stocking and draining local aggregate for the required time and quantity limits; fixing the dividing line between acceptable and unacceptable coatings on particles; and checking results of field inspectors by laboratory representative.

Advantages and Disadvantages of Local Pits

From the standpoint of cost, local aggregates should prove economical in outlying locations, since freight is such an important item. Opposed to this are the relatively heavy investment and overhead *per unit* of aggregate produced, and the lesser certainty as to quality and supply. The first season in any plant is a period of tryout and adjustment, and for a local plant every year is a first year. Contractors are usually delayed, and often specifications may need to be interpreted liberally to maintain the construction schedule New pits do not always come up to expectations, and reserve supplies are smaller to carry the job over whenever trouble is encountered, than in the case of larger plants.

Local pits in marginal shipping locations should be able to offer lower aggregate prices which would result in lower bids for paving. In locations outside of permanent plant competition it is questionable whether such lower prices would obtain. From the standpoint of the state as a whole (not the highway department alone), this is partially offset by the losses in tax returns to the state, both direct and through the railroads. The state also benefits indirectly through increased employment of train crews and through maintaining the established channels of industry —permanently operated plants. (In one case, a paving job kept seven train crews busy for several weeks, whereas a competing plant was said to have planned to haul the material a relatively short distance in trucks.)

Advantages and Disadvantages of Permanent Plants

This discussion of course relates very closely to the two preceding paragraphs. Permanent plants offer a permanent investment of large proportions, subject to tax and serving the community in other interests besides paving—a factor which should reduce the cost of building and other construction. The personnel is relatively stable in location, and employed for a longer season. Equipment is more flexible to take care of changes in supply or unusual requirements in demand. (In one case experimental aggregates were produced by a commercial plant at considerable expense without increase in price. In another plant, in Wisconsin, a permanent plant served as an experimental laboratory for a government study of aggregate production.)

The permanent plant offers a surer prospect of continuous supply, satisfactory quality and good yield. It is also more convenient to inspect. To the railroads of Minnesota the permanent plants mean about three-fourths of the shipped tonnage and over seven-eighths of the ton-mileage.

An objection to the centralizing of aggregate production is the possibility of monopoly. Minnesota is so well overlaid with good gravel, however, and has already so many permanent plants at well distributed locations, that a commercial plant monopoly is no more likely than is the indicated monopoly in local supplies. Competitive conditions are unusually severe.

Conditions in Wisconsin and Iowa

A brief investigation of the status of local plants in neighboring states served to confirm the above observations. In Wisconsin, local pits have been developed longer and to a greater extent than in Minnesota; in Iowa, for a shorter time and to a lesser extent. In general, the Minnesota local plants appeared well set up and equipped, in comparison with other states.

In Iowa an arrangement had been made whereby inspection of aggregates for state paving work was checked by a commercial laboratory engaged by the aggregate producers' association In the case of a local pit whose product was strongly believed to fall short of specifications, the commercial tests found satisfactory aggregate. Commercial testing began, however, after plant operators had been notified.

Contractors

Of the contractors interviewed the majority preferred to buy aggregate from established plants, prices being equal or nearly so. This was because of better service. Some were apprehensive of a virtual monopoly on local pits at strategic points, based on the expected highway program. It was generally felt that the contractor should not engage in aggregate production, but should leave this function to specialists who are familiar with the conditions, risks and costs of opening new supplies. It was indicated, however, that if monopoly developed to an extent of making price favoritism among contractors practicable, other contractors would take matters into their own hands by developing new local supplies.

Contractors were divided in their opinion regarding the advisability of the highway department's policy of letting some jobs in the fall for the following year's construction. Considering the aggregate man's viewpoint alone, it is evident that early lettings favor local producers by giving them longer time to explore, set up and start production —functions which are more nearly continuous in the established plant. It was noted that the majority of jobs let in the fall were furnished from local pits.

No definite criticism was offered by contractors of the inspection rendered during the season, although a few instances were cited of temporary letdowns. The association representative was unable to reach any of these before conditions had been corrected. First-hand, he saw very little aggregate that might be classed as unsatisfactory.

The Railroads

It would seem that the railroads collectively would interest themselves to a greater extent in the question of aggregate shipments, which now amount to approximately 100,000,000 ton-miles in the state annually. About 92% of this ton-mileage is produced at permanent plants, but next year's percentage will undoubtedly be lower (at existing rates), as the prospects are for next year's pavement to be less centrally located. So far, rate reductions appear to have been chiefly individual attempts to get business from competing railroads. The real problem, however, lies in some such measure as a lower schedule of rates (at least for the longer hauls) to retain business now expected to go to local deposits.

It is noted that the recent national application of the railroads for a general rate increase provided for exceptions in the case of short hauls (even a long aggregate haul is considered a short railroad haul). In view of the simplified nature of aggregate ship-

ments, such as the class of equipment required and the bulk of units handled, it is believed that a careful study of this problem is justified and that lower rates will tend to maintain railroad business and profits.

Possibility of State Purchase or Regulation of Aggregates

Conflicting opinions were received as to the advisability of a state policy of purchasing aggregates. Strenuous objections were voiced to a system of buying aggregates on a blanket basis, f.o.b. plant, for the season, without knowledge of specific requirements or jobs. Such a policy has been tried out in Iowa and abandoned. Less objection was raised toward a suggested policy of the state buying aggregate for *each* job, at the job. It may be said, of course, that the state buys cement and that, to be consistent, it should buy aggregates. Cement, however, is more of a standardized commodity than is possible or necessary with aggregate, so that the two cases are not exactly parallel. Contractors had vigorously opposed the state purchase of cement, and no doubt a majority would do likewise with aggregates, feeling that it invaded their functions. The above discussion is offered without comment, as the writer has no well-defined opinion on the subject.

One suggestion which has been made, with a view to improving and equalizing the quality of aggregate from large and small plants, is to specify certain minimum requirements in plant capacity, water supply and pressure, screen area, etc. This has been done to a certain extent with concrete mixers and finishing machines. The idea has good possibilities, but it is difficult to set such minimum requirements in view of the differing clay contents and other characteristics of the deposits. Moreover, there is a strong probability that aggregate producers as a whole would oppose the policy on the grounds that it usurped their functions.

1932 Prospects for the Aggregate Industry in Minnesota

The largest single use of aggregate is in concrete for state highway pavement. The 1932 paving program may be estimated fairly closely, and that for succeeding years with less accuracy. It is evident, however, that existing plant capacity is far in excess of needs, and also that a greater percentage of aggregate will be supplied from local deposits (in spite of their higher production costs) unless adjustment is made in the present scale of railroad rates. The present natural supplies of gravel in Minnesota are generous, and these combined with existing plant over-capacity and low labor costs should guarantee to the state a plentiful supply of high quality aggregate at reasonable cost.

Summary

It is difficult to state in a few words a problem which has so many angles; however, the following will summarize the main observations of the summer:

An increasing proportion of aggregates for concrete highways is being furnished from local deposits using portable plants (24% of total tonnage in 1931). This will probably increase in 1932, as pavement construction will average a greater distance from the present centers of production.

Production costs of local plants are generally higher than those of permanent plants. Their ability to compete lies in railroad freight rates, which appear unduly high considering the nature of the service.

Indirect factors tend to lessen the apparent economic advantages of the local pits. Chief among these are questions of employment and taxation, the latter including both direct and railroad taxes.

So far as quality of product is concerned, the local plants are equipped to turn out aggregates meeting state specifications, and they compare favorably with local plants in other states. Washing and screening facilities are generally improved over those of previous years. Considerable prospecting for new supplies has been carried out.

Unusually rigid inspection should obtain at local pits (*a*) because of the uncertain nature of materials to be encountered and the necessity of adjusting the plant to them, and (*b*) because the material is inspected only once, whereas shipped materials are inspected twice.

State purchase of aggregates is under consideration, but its probability appears slight unless further factors (such as a monopoly) develop.

Considering the size of the program, the number of men involved, and the variety of plants and materials, very little aggregate was used which might be considered unsatisfactory.

Contractors as a rule prefer to obtain aggregates from a plant of ample capacity and service-proved quality of product.

No consistent or cooperative effort by the railroads has been noted in the direction of meeting local pit competition. Some system of winter shipping might be worked out economically.

Other conditions being equal, a balanced highway program could well include projects in each major production (or shipping) territory.

Dr. Ralph J. Watkins, director, Bureau of Business Research, University of Pittsburgh, Penn., read identically the same paper that he did at the National Crushed Stone Association convention a week before, which is abstracted elsewhere in this issue.

Col. Willard T. Chevalier, publishing director, *Engineering News-Record,* New York City, in a splendid address, "Where Do We Go From Here?" presented a moderately optimistic outlook, calling attention to our repressions of desires at some time to be fulfilled at present price levels, the vast amount of credit and cash resources available and the over-deflated condition of business in general. After furnishing the proper ground work for a tremendous future development, he emphasized what is often overlooked—that the debt burden which now looms so large in both private business and public is relative; when assets go down, debt becomes a far greater burden than with assets at a normal value.

Speaking specifically of the outlook for the construction industry, he pointed out its essential difference from other business in that it is the business of fixing capital. In other words, of the development of real property or assets. Now this capital, Col. Chevalier made clear, must come from the surplus earnings of the people or from borrowing. The very basic problem of capitalistic society is to determine the proper division of surplus wealth between that to be spent for consumption and that to be spent for capital investment; and to solve such a problem adequately required a master mind—supernaturally so. He gave figures in analyzing construction for the years 1929, '30 and '31, in which he brought out that the volume of engineering construction in 1931 was 77% of the volume in 1930 and 62% of the volume in 1929.

Public works construction in 1931 was 102% of 1930; and 105% of 1929. Private construction was 58% of 1930 and 40% of 1929. These are comparisons of dollar values and do not consider the actual volume of construction materials used. To do this we would have to take into account that the dollar in 1929 was worth 16½% less in terms of such materials than in 1931, making the volume of materials used correspondingly larger.

Going back to 1925, which he considered a year with which no one was particularly dissatisfied as regards volume of business, he said the construction volume in 1931 was only 4% lower than in this year of 1925.

Col. Chevalier thought that the present time was a particularly good one to fix capital in real property, because of the very low prices. He pointed out that there were three factors in every construction operation, (1) the operator or promoter; (2) the investor; (3) the agency of investment (the banker or financier).

Analyzing the present mental attitude of each, he said that (1) the promoter shrinks from the present situation because of his belief in the overbuilt condition of the market; (2) the investor is doubtful, mistrustful and uncertain, fearing the burden of unliquidated indebtedness, under which the public is staggering, fearing for the purchasing power of the people. The investors want to believe that all capital available must be used to liquidate the present indebtedness; (3) the financier fears that he must continue to maintain liquidity and prefers security to his opportunity of a return on new capital.

Colonel Chevalier stated quite clearly that it was obvious from a study of these factors that one could not judge the potential demand for construction on the present basis, because standards of floor space are far from static and that there is normally a constant demand for more modern facilities. He said he was not frightened by the decrease in the rate of population increase; that our needs were governed more by our desires and our ability to gratify them by an increase in population.

He pointed out the potential markets for new products and new industries.

Colonel Chevalier said our greatest problem, of course, as everyone realizes, is the restoration of public confidence, and he stated that he believed the government was fully doing its part. The liquidation of indebtedness he thought was an excellent thing and would be our salvation and permit us to go ahead later with fewer handicaps.

He then launched into a discussion of competition and stated that while he favored the elimination of wasteful and destructive practices and advocated a coordinated construction industry, he still believed in the law of "survival of the fittest" and the elimination of the high cost or marginal producers. He said we think altogether too much about business in general and not enough about our own particular business. He said no attempt should be made by cooperative or association efforts to perpetuate the weak sisters in industry and that to attempt to do so by loans and credit expansion would be unsound economy.

He said there must be no pressure to inflate prices, and attention should be paid to see that credits made available by the government and other resources are not squandered; using as an example the utter folly of using large numbers of laborers in order to remedy unemployment conditions. He illustrated his point by saying that if it was a sound argument that it was desirable to replace a steam shovel with hand shovelers, by the same line of reasoning it was desirable to replace hand shovels with teaspoons. Consequently we must foster construction programs that have economic justification, and we must combat fallacies that produce only temporary relief.

Colonel Chevalier said he was opposed to stabilization programs, on the theory that progress can be made only by increasing the productive ability of the individual and that any attempt at stabilization was too apt to result in putting a premium on inefficiency. This did not mean that he favored destructive competition, he added.

The business conditions in the industry during 1931 and the outlook for the future based on reports of the producers in the various parts of the country were very similar to those reported in Rock Products of January 9. Producers as a whole are remarkably hopeful and confident.

Specifications

F. H. Jackson, U. S. Bureau of Public Roads, read a paper on "Designing Concrete Paving Mixtures by Water-Cement Ratio Trial Method," in which was given a vast amount of information of great value both to sand and gravel and other aggregate producers. For want of space here we will publish an abstract and digest of the paper later by Edmund Shaw, contributing editor of Rock Products.

H. S. Mattimore, engineer of materials, Pennsylvania State Highway Department, Harrisburg, Penn., discussed "Some Comments on Aggregate Specifications," extracts from which follow:

"The basis of a good specification is a thorough investigation to determine what are the essential qualities to designate. This means a study of the past use of products, with a study of the products that are available. Therefore these two points should be emphasized for a guide in drawing any specification.

"1. Ascertain the products that are available, and what preparation is necessary and practicable.

"2. Ascertain the essential qualities of a product to assure success in construction.

"In other words, for economic construction we must give consideration to materials available within economic haul, but at the same time determine from service tests what are essential qualities in an aggregate for durability.

"Aggregates that have proved their merits in the past in durable structures form a good basis for quality. But this is not as easy to interpret as it may seem, in that other factors, such as quality of construction and adequacy of design, have to be considered.

"Good specifications are desirable to a producer of aggregates. When he has to furnish material it is of great advantage to him to know that any competitor has to furnish material of equal quality. In many cases the production of this quality requires expensive preparation which has to be added as a part of the cost. Therefore consumers who have specifications which require quality materials properly prepared are desirable purchasers, in that all purchases are on a fair basis. The producer by cooperating with the engineers can show just what can be accomplished in the preparation of the materials, and also give some indication of what it might cost to furnish material meeting certain requirements. Further, he can keep his business on a high basis and secure the good will of the engineer by making an earnest endeavor to furnish material which he agreed to do under certain specification requirements. It is not that most well organized consumers do not desire to furnish such material, but they are not organized to insure this. In case of the rejection of any materials it is placed up to the superintendent or some of his subordinates. My opinion in this regard is that a well regulated aggregate producing business have instilled quality so well in the minds of the superintendent and his subordinates that errors and mistakes are very rare exceptions. This point is illustrated quite clearly if a study is made of the uniformity of the product secured from different aggregate producing companies.

"Different uses for aggregates in new or modified types of roads are devised in many different locations. It is very difficult for highway engineers to keep in contact with all of this work, but it is essential that aggregate producers should do so. This is where the technical associations are of value.

"Certain types of highway surfacing have been used with success in different parts of the United States. The same methods of construction may and may not be applicable to other sections. I frankly believe that a technical organization can be of most value in this regard by making a personal inspection on these types of roads under construction, ascertaining their service value, and be in a position to furnish engineering service to states, counties, and other civic units where these types of roads, or an application of them are suitable.

"Technical organizations of the associations, and some of the other national associations, have done some excellent service to date, but they are far from being in a position to function one hundred per cent. until such technical organizations are expanded so as to furnish engineering service in the field to the member producers and construction engineers.

"I realize that under these conditions this recommendation may be criticized, but I have given due consideration to all conditions in recommending it, in fact I believe that an association or organization which weakens a technical division at this time, providing such a technical division has functioned efficiently, is making a serious mistake. Now is the time to seek additional outlets for products, in fact the future existence of many organizations will depend to a large extent on the broadening of their field. No technical division in any national organization should attempt to promote themselves by condemning any other product. This is never looked upon favorably in any engineering field. After long service quality in products will indicate themselves, and any condemnation of the competitor's material weakens rather than strengthens the organization making them.

"I believe your technical division, along with some other associations, have started some good work on standardization of sizes. There may be a possibility of

standardizing aggregate sizes throughout the United States, but the essential thing to be accomplished at this time is to reduce the number of sizes produced by the larger companies shipping to several states or different communities.

"Further reference has been made to standardizing the shape of the testing screen openings. I believe this is a larger problem than the standardization of sizes, and I cannot conceive of it being a major problem at this time.

Uses for Gravel Aggregate

"Gravel aggregate is sold in many locations in competition with crushed stone and slag. Gravel is used to a large extent as concrete aggregate, and to some extent on macadam roads. Highway engineers are far from being convinced that uncrushed gravel aggregate is a suitable product for all courses on macadam roads. It has been used successfully as a base in some locations, but there is such a difference in the gravel aggregate produced in the different parts of the United States that a study should be made by your association relative to the methods of its use in such construction.

"During this past year we attempted, by means of specifications, to have gravel producers prepare an aggregate which we believe would give better success in macadam construction. This calls for 80 to 90% crushed particles. Considerable objection was presented to such specifications. As the season progressed these objections were lessened, and many producers are interested in not only producing this product, but claim that during the next year they will be on the market with a gravel which will meet a specification calling for 100% crushed particles.

"This is a progressive move on the part of gravel companies in preparing a material which should be suitable for use in all types of macadam roads. Crushed gravel particles can be interlocked under the action of a roller, thereby overcoming previous objections to the use of gravel in macadam construction. It is assumed that the quality of the gravel has been given due consideration, as the shape of particles is only one factor. Shale content and soft gravel particles would be especially detrimental in a macadam road.

"Coming to the special requirements for work under the supervision of the Pennsylvania Department of Highways, attempts have been made in preparing these specifications to try and use the different size products produced from commercial plants. Unfortunately in any road program it is practically impossible to carry on different operations so various size products can be shipped as produced. This necessitates plant storage for which proper provisions should be made.

"I made mention of considering the use of 100% crushed gravel. Under normal crushing operation it is expected that this will be produced from the oversize particles and would require special preparation. A field is being sought on smaller size pea gravel, which in many operations is a waste product. I have very little to offer regarding the use of this product at the present time, except that some of our specifications for low cost rural roads allow a certain amount of this product in the larger sizes.

"The specifications for aggregates on the low cost road are naturally much broader and do not require the care and preparation as aggregates which are used in higher class construction. The term 'low cost road' itself indicates that low cost materials must be used. This does not refer so much to quality as it does to preparation.

"Although not officially adopted at the present time thoughts have been given to establishing several specifications for gravel, that is, natural uncrushed gravel only requiring screening preparation so far as oversize and excess of fine particles are concerned, uncrushed gravel screened to designated sizes, crushed gravel containing 40% of crushed particles and screened to designated sizes, crushed gravel containing 80 to 90% crushed particles and screened to designated sizes, and fully crushed gravel containing 100% crushed particles and screened to designated sizes. Up to the present time this fully crushed product has been limited in supply, but it is found to work successfully in macadam construction."

P. J. Freeman, chief engineer of tests, Department of Public Works, Allegheny county, Pittsburgh, Penn., discussed production problems from the point of view of a user of the product. Particularly he emphasized the necessity for more attention to quality. The object of specifications is to define quality; and with conditions as they are at present, he was sure more and more emphasis would be put on quality.

The all-important thing engineers and builders look for is the permanence of their structures. Under quality Mr. Freeman listed cleanliness of the product, so far as the sand and gravel industry is concerned, as the most important attribute of quality. He spoke of the desirability of standardizing sizes of product rather than the testing sieves. Upon the subject of crushed gravel he said that one advantage of crushing gravel is that it helps very materially to eliminate soft material, which otherwise got into the finished product. He criticized the attitude of some employes of sand and gravel companies who always took the attitude that the material turned out was "good enough," and said that a method should be devised to fix the responsibility at the plant for turning out a quality product. One way to do this was to label each shipment with a description of the product, and he urged a uniform system for such descriptions. He suggested a "quality inspection man," an employe of the company at each plant, who would observe and properly label every shipment of material.

He said he could see no reason why the aggregate industry should not recognize that it produced first and second quality products and not always a first quality product.

Uses of Products

The papers at the sessions on Friday were very complete, covering a very large part of the field for sand and gravel products. Great interest was shown in the rapidly growing use of gravel for secondary road surfacing in combination with asphalt or other bituminous mixtures.

Bernard E. Gray, highway engineer, the Asphalt Institute, New York City, read a paper on this subject, an abstract of which will be published later.

W. J. Emmons, director, Michigan State Highway Laboratory, Ann Arbor, Mich., dealt with the subject from a little different angle, emphasizing particularly the effect of characteristics of bituminous materials on applicability to different types of aggregates. We will leave an abstract and discussion of this paper for a later issue.

E. M. Fleming, manager, highways and municipal bureau, Portland Cement Association, Chicago, Ill., covered very adequately and comprehensively the arguments in favor of the use of stage construction of highways, using temporarily single track strips of concrete in lieu of cheaper types of construction for the (at present) less traveled highways. We will publish an abstract of this paper in a later issue.

Charles B. Stanton, associate professor of civil engineering, Carnegie Institute of Technology, Pittsburgh, Penn., discussed the use of gravel as railway ballast. Abstract of Prof. Stanton's paper follows:

"In the first 'Manual of Recommended Practice' of the American Railway Engineering Association, issued under date of 1905, gravel was described as 'Small, worn fragments of rock, coarser than sand, occurring in natural deposits.' Sand was described as 'Any hard, granular, comminuted rock material, finer than gravel and coarser than dust.' These definitions, while very liberal, left considerable ground for debate. The specification for gravel ballast in the same manual was as follows: 'Gravel should be screened or washed where prevention of

dust is an object, but this need not be done where the character of traffic is such that dust is not particularly objectionable. It is recommended that gravel be screened or washed where the proportions of sand and clay exceed 50%. The minimum size of such is that retained on screens of 12 meshes per inch. By this is meant the size pebble that would be retained in a thorough, careful test.' This specification seems a far cry from the present requirements which are placed upon a first-class gravel ballast.

"The present specification still retains three types of gravel ballast and has substituted for washed gravel ballast the name 'prepared gravel ballast' with the thought of permitting the use of sources of supply which fulfill the specifications without further preparation than grading.

"There has been and is a feeling prevalent among some railroad maintenance men that gravel ballast will be covered eventually by crushed material of some type. This attitude has been stimulated by their own methods of producing or specifying gravel. Their intent has been to first apply only such a material as will finally give them the best sub-ballast.

"The load distribution under the tie of a railroad gives a point of maximum intensity directly under each rail, and points of minimum intensity at the ends and at the center. When the ballast is shallow under the tie, these points of maximum intensity are very definite and throw a disproportionate load on the sub-grade at these points, while the center and sides of the sub-grade carry little or no load. As the thickness of the ballast increases, the distribution of these loads becomes more uniform, which tends to distribute to the various parts of the sub-grade a more uniform load.

"In a similar manner, gravel ballast which does not contain a variation in sizes of particles such as will furnish innumerable bearing surfaces between the base of the tie and the sub-grade, must in itself be displaced until the load is transferred to the sub-grade. Gravel of graded sizes have many more surfaces in contact to transfer load while that of random sizes have relatively few to bear the same transfer of load. In our efforts to increase this load bearing value, we must not lose sight of the fact that the drainage must not be impaired.

"It is stated that the addition of crushed particles materially increases the bearing value of a given ballast. Is not this increase in bearing value accomplished by bringing more surfaces into contact so that they may take their share of the load transfer? Furthermore, cannot this same increase in load transfer be accomplished by the proper grading of the particles and the delivery of such a graded ballast to the point of application without any serious segregation of sizes?

"In view of the results of recent tests carried on by producers of other materials, I believe this subject is worthy of more intense study by your association.

"In order to further improve the prepared gravel for ballast, the American Railway Engineering Association has instructed its sub-committee of the ballast committee to further study the specifications and test.

"For the past few years this committee has profited by the advice and cooperation of your association's director of engineering and research, Stanton Walker, as a member. Furthermore, we have before this committee valuable data furnished by certain of your member companies. These data, we believe, will give us valuable assistance toward the solving of our problems.

Your association's laboratory has carried on studies and has obtained data on accelerated weathering, hardness, and abrasion, and also on the bearing value of various gradings. This generous cooperation is greatly appreciated by the committee and has been acknowledged by our association."

Safety

H. W. Heinrich, assistant superintendent, The Travelers Insurance Co., Hartford, Conn., discussed "Practical Safety Methods Applied to the Sand and Gravel Industry," abstract of which follows:

"The sand and gravel industry, in common with other industries, bears a tremendous financial burden in the cost it pays annually because of injuries to its employes. The employes suffer financially, too, and in addition are distressed mentally and physically. The burdens thus borne jointly by employer and employe are needlessly heavy. A reduction of 50% may readily be achieved by employing certain practical methods in accident prevention, which have proved to be highly successful.

ACCIDENTS COSTS IN THE SAND AND GRAVEL INDUSTRY

Total annual income	$115,176,543
Annual payroll	33,526,228
Average compensation rate per $100 of payroll	5
Compensation premium	1,676,311
Direct losses	1,005,786
Indirect losses	4,023,144
Total losses	5,028,930
Total accident cost in per cent. of payroll	15%
Total accident cost in per cent. of income	4.3%

"An individual sand and gravel operator who desires to know his approximate total annual accident cost may estimate it as 300% of his compensation-insurance premium for one year. If he is paying $5000 annually, for example, his accident cost, including both direct and indirect losses, is $15,000. Of this sum at least half may be saved, in the average case.

"As a first principle of practical safety work, it must be admitted that executives should lend their interest and support and should enter actively into the direction and supervision of accident-prevention work.

"Executives should bear in mind that industrial problems are best solved when action is based on pertinent facts. This is as true of accident prevention as it is of other problems Since everything cannot be done at once, there should be concentration on facts of major interest. In accident prevention these facts relate to unsafe practices of workmen, and the causes for these practices and to mechanical hazards.

"There is no particular difficulty in controlling accident experience when the executives are interested, when the essential facts are known, and when suitable action is taken.

"Suitable executive machinery now exists in every well conducted sand and gravel operation, to take care of accident prevention without changes, additions or excessive cost. This is true because the causes of accidents and the methods for accident prevention are exactly the same as the causes and methods relating to the control of quality and volume of production. Trained business executives well know how to deal with employes who disregard instructions and consequently spoil materials or delay production. No particular trouble is experienced in getting men to report for work at a given time or place. There is no difficulty in enforcing the hundreds of rules that are necessary for the economic and profitable functioning of an industrial enterprise. There is no difference between the control of such things and the control of accidents—except attitude.

"Employers have a right to expect that wage-earning employes will obey the rules that have been laid down for them. They have a right to expect that supervisors or foremen will see that the workers follow the rules, because these supervisors are paid to do exactly that. (These assertions clearly apply to *all* rules, whether they relate to production or to safety.)

"It is only necessary, therefore, for the executives to take a personal and active interest in safety, to determine by analysis exactly what is wrong and why it is wrong, and then apply the needed pressure to get results.

"No one will disagree with the statement that it is easy to cure a given trouble provided (1) the cause of the trouble is definitely known, (2) the cause can practicably and effectively be attacked, (3) the will to attack it exists and (4) the proper action is initiated and followed up."

Sales Advice

E. J. Doyle, president, Doyle Gasoline and Oil Co., distributors of Texaco products at Rochester, N. Y., gave a very interesting and inspirational talk on sales lubrication, some extracts of which follow: "The interesting thing is how we have been able to increase our business in 1931 50% over 1930 in this time of depression.

"The ideas we have used have been obvious ones. We haven't tried to say something simple in words that no one can understand. When we were convinced that Texaco gasoline starts quicker in cold weather than any other gasoline, we said in our ads that 'Texaco starts quickest.' Other companies advertised that their gasolines had climatic control, starting impulse, and other things like that, trying to evolve some method of saying quick starting in words which meant nothing. This applies to almost any business. In developing any selling and merchandising ideas, do the obvious thing—don't beat around the bush. You can't change a live elephant so he'll look like anything but an elephant no matter what you do to him, and more people will know what you mean if you call him a jumbo elephant than if you call him a ponderous pachyderm, even though the latter may sound more 'high falutin' and may have been developed in a conference and smoker of high priced advertising agency executives.

"If you haven't faith in what you are doing and in your ability to do it you are licked before you start. With the faith you *can* do it, develop a sales idea that your competitor hasn't got and you will quickly acquire some of his business. Don't get yourself befuddled in your business like the girl who thought he rsweetheart was going to take her on a trip to France because he told her that after they were married he'd show her where he was wounded in the war. Develop your sales or merchandising idea and have the faith and courage to put it over!

"Salesmanship after all is the ability to think of an idea and the ability to sell it! Don't be afraid to consult with your men. The man with the poorest job in your company has at least some idea of how he would sell your product and can often furnish you with the seed of an idea that may be developed into real sales.

"When you send out a salesman, to sell a prospective customer, do you give your man a slap on the back and say, 'Go out and land him, Joe!' or do you sit down with him and analyze that customer and endeavor to figure out the best way to sell him."

Association's Activities

With the limited space available we will have to skip over a great deal of interesting material brought out in the report of the exexutive secretary, **V. P. Ahearn,** and report only a few brief extracts:

"There is one outstanding and significant thing concerning the National Sand and Gravel Association which is worthy of comment at the opening of this report, and that is the fact the industry which it represents, in these times of adversity, has not withdrawn even in the slightest degree the measure of its support. Indeed, the association had more members at the conclusion of 1931 than it had when the year began, and numbered among the new member companies are some of the outstanding producers in the United States as well as in Canada. This circumstance, we believe, is indicative of an even greater appreciation by the industry of the value and indispensability of the association.

Freight Rates

"It has invariably been the policy of the association to look upon the question of freight rates as a local problem, and therefore that it is not something which should engage our attention. This rule is subject only to the one exception that when a proceeding involves the establishment and construction of freight rate schedules on sand and gravel throughout a whole territory or the entire United States, a situation is created which demands the intervention of the association. The logic of this reasoning was amply demonstrated in 1931 when the carriers filed a petition with the Interstate Commerce Commission for authority to impose an increase of 15% in rates on all freight traffic.

Objectionable Trade Practices

"When certain current questions with respect to the work of the Federal Trade Commission are answered, the association proposes to hold a trade practice conference of the sand and gravel industry. At the moment some members of Congress are challenging the authority of the commission to conduct these conferences, although several industries have already used this procedure in an effort to eliminate objectionable trade practices. If it is determined that the commission was not exceeding its legal limitations, it is our opinion that the trade practice conference would enable the sand and gravel industry to coordinate its natural desire to put an end to a number of practices which are acknowledged to be harmful to the industry and of no real benefit to the public. But until we secure a definite understanding of the proper functions of the commission, it seems proper for the association to withlater on by Edmund Shaw.

Engineering and Research

The annual report of the engineering and research division was quite a lengthy document and we will publish an abstract of it later on by our Edmund Shaw.

Officers Elected

Harold V. Owens, president, Eastern Rock Products, Inc., Utica, N. Y., was elected president of the association, succeeding Robert J. Potts, president, Potts-Moore Gravel Co., Waco, Tex., who had served two terms; J. C. Buckbee, president, Northern Gravel Co., West Bend, Wis., and consulting engineer, Chicago, Ill., was elected vice-president, succeeding Harold V. Owens; and Otto S. Conrades, vice-president, St. Louis Material and Supply Co., St. Louis, Mo., was elected a member of the executive committee, succeeding Mr. Buckbee. The other members of the executive committee remain as before, namely, Paul P. Bird, president, Boston Sand and Gravel Co., Boston, Mass.; Alex. Foster, Jr., vice-president, Warner Co., Philadelphia, Penn., and Frank W. Peck, president, Peck-Thompson Sand and Material Co., Kansas City, Mo. Harry S. Davison, secretary-treasurer, J. K. Davison and Bro., Pittsburgh, Penn., was reelected secretary-treasurer of the association.

A very unusual honor was paid to Edmund Shaw, contributing editor of Rock Products, by his election to honorary membership in the association, Mr. Shaw being the first and thus far the only honorary member.

The registration list of the convention will be published in a succeeding issue because as this issue goes to press the complete list is not available.

Find Zinc in Ohio Limestone Quarries

RECENT EXAMINATION of the Blue Rock, Inc., quarry two miles north of Greenfield, Ohio, disclosed that zinc ore in small quantities is in a stratum of rock some 30 ft. below the surface, the quarry now being 55 ft. in depth.

It is the fourth place in Fayette, Highland and Ross counties that the deposit has been found, the first being in the Smith quarry, 2 mi. south of Highland; the next being in the Cincinnati quarries across Paint creek from Greenfield; the next in the Garringer-Hyer quarry at Rock Mills.

The largest deposit seems to be in the Smith quarry, where nodules testing as high as 65% zinc have been removed.

In the Smith quarry the zinc was found in what is known as a "dome," with indications that it might be in paying quantities there, but in the other quarries it is found in a stratum of rock some 2 to 3 ft. in thickness, and appears in the form or nodules scattered through the brownish limestone.—*Washington Court House* (Ohio) *Herald.*

Review of Papers Read at Association of Asphalt Paving Technologists

SEVERAL papers of importance to producers of aggregate were read at the annual meeting of the Association of Asphalt Paving Technologists, held in Detroit, Mich., January 14. One of these on mineral filler, by J. S. Miller and R. N. Traxler, is rather more informative than any paper the reviewer has previously read on this subject. It gives the characteristics a good filler should possess and shows how to test for these and evaluate them.

Particle size, the paper says, ranges from the ultra-microscopic to 75 microns, which is practically 200 mesh. The paper gives the size openings in microns of sieves below 100 mesh, and shows that the finest (400 mesh) is too large to evaluate the finest powder. Elutriation, or sizing by rising currents of water, leaves much to be desired. For one thing, the wetted and dried products are not fit for further study. The same is true of sedimentation. Air analysis is the most satisfactory method.

For this the authors use the apparatus devised by the U. S. Bureau of Mines (described in Rock Products, December 19, 1931). With this seven fractions below 200 mesh have been made and six of them were finer than 400 mesh (38 microns). Closer work than this can be done if necessary. Examination by the microscope is the final step in studying powders, but it should be preceded by air separation if the work is to be accurate. A projection microscope is needed for measuring the finer particles.

Determining Surface Area

The best method of determining surface area is to calculate it from the surface mean diameter, according to the paper. Experiments in determining the surface area by the adsorption of dyes, asphalt and other substances are described and the reasons why they are inadequate are given. Determination by solution is mentioned but is not recommended.

Shapes of particles obviously must be determined by the microscope and the paper recommends the use of a projecting microscope for this. Micro-photographs are recommended for a permanent record.

Voids are measured in two ways. The first is to find the specific gravity of the mineral itself, which is done in the usual way by a pycnometer. The pycnometer and its contents are subjected to a vacuum for some time in order to remove all the air from the powder. The bulk specific gravity is found by putting the cool dry filler in a centimeter tube and tapping until there is no further settlement. The weight of this powder in grams divided by its volume in cubic centimeters is the bulk specific gravity. Then per cent. void space equals $100 - 100\left(\frac{\text{Bulk specific gravity}}{\text{Specific gravity}}\right)$.

The other method is by liquid adsorption. Twenty grams of the dry cool powder is placed in a beaker and a liquid (best is a non-viscous, non-volatile, non-drying mineral oil) allowed to drip on it from a burette. A ball will form and the wet lump should be rolled around until all the powder has been picked up with the beaker remaining dry. The volume of liquid used in doing this is read from the burette and taken as the void space in 20 grams.

Recent work on voids in fine powders has shown that void space increases slowly with decreases in the size of particles until about 15 microns is reached. After this the increase in voids is rapid.

Representative fillers have been examined and the table gives data on one which is typical. The surface area was found from the surface mean diameter, which is found from the average diameters of the particles by dividing the sums of their cubes by the sums of their squares. The measurements were made by the use of a projecting microscope. The surface area was calculated by the formula:

$$S = \frac{6 \times W \times 10^{-3} \times 10^{4}}{p\, d_s}$$

where W is the weight per cent. of the fraction of the sieve analysis, p is the specific gravity of the mineral and d_s is the surface mean diameter of the fraction in microns.

Size fraction (microns)	Per cent. by weight	Surface mean diameter in microns	Surface area in 1 gram of original dust (sq. cm.)
-2	8.48	1.00	1988
2-4	10.24	3.00	776
4-7	8.02	5.50	331
7-10	7.78	8.50	205
10-20	25.11	16.73	336
20-40	26.29	31.75	185
40-75	13.07	57.95	51
+75	1.01	105.00	.....
Whole powder	100.00	5.94	3872

The paper also gives a brief discussion of the effect of certain characteristics of filler on the bituminous mortar that fills the spaces between grains of sand or aggregate. These are of a shape and texture for which there is at present no test. Other characteristics discussed are size and size distribution, voids, and finally the area and nature of the mineral surfaces presented to the asphalt.

Devising a Test for Designing Cold Road Mixtures

A paper by C. H. Stokes and Joseph Zapata, materials engineer and assistant engineer of the Wisconsin Highway Commission, described a test for the stability of bituminous cold road mixtures. The design of hot mixes, according to this paper, has been so developed that consistent results may be obtained. But the rule is that results with cold mixes are "ununiform and at times slightly discouraging," to quote the paper.

The Wisconsin Highway Commission tested several machines and methods for evaluating cold mixes and finally adopted a device which has been used in principle since 1846 for the determination of the coefficients of adhesion and cohesion in soils and sands. It consists of two boxes, both 4x4x8-in., so placed that one can move over the other along their longitudinal axis. The lower box has a movable bottom for using specimens of different depths and for leveling specimens. Test specimens were formed by a Bureau of Public Roads machine. These specimens were 4x2½x8-in. and they were also made in the testing machine by filling the boxes with a mixture of predetermined weight, carrying a definite percentage of bitumen. This mix was compacted with care to have the same depth, the same degree of compaction and to have the upper surface level. The movable bottom is placed so that half the specimen is in the upper and half in the lower box.

Method of Operation of Equipment to Test Cold Road Mixes

A load N is placed on a platform on the specimen and pulls P are applied by a slow motion screw and measured by a dynamometer. An Ames dial placed on the side of the lower box registers displacement in hundredths for the various pulls.

The pull P, according to principles first stated by Coulomb, equals the coefficient of friction f times the load N plus the coefficient of cohesion, or cohesion per unit of area k times the area of the plane along which the force is exerted, or:

$$P = fN + kA$$

For testing the specimens, three loads N have been used: 481, 911 and 1341 lb. per sq. ft. The pulls P are applied at a rate of 0.238 in. per min. Displacements are read until the dynamometer needle ceases to register an increase in pull. Time readings, in seconds, are taken for each displacement reading.

Graphs are plotted using displacements as abcissas and time, in seconds, and pull P in lb., as ordinates. Other graphs are plotted using pulls P as ordinates and loads N as abcissas. Both P and N are used in terms of pounds per unit of area.

Growth of Ready Mixed Concrete Industry Shown at Second Annual Convention

THE SECOND annual convention of the National Ready Mixed Concrete Association was held at the Hotel William Penn, Pittsburgh, Penn., January 25-26, 1932. A most interesting meeting was had with representatives of some 35 producing companies in attendance and total registration of 166. The increased acceptance by the building and construction industry of the use of ready mixed concrete speaks well for the character of the early development and the high standards which have been adopted by ready mixed concrete producers.

The session Monday morning was opened by President **J. E. Burke,** who reviewed the work of the association during the past year and outlined the program for the coming year.

Cloyd M. Chapman, consulting engineer, New York City, was first on the program with a paper on "Ready Mixed Concrete from the Viewpoint of the Architect and the Engineer." Mr. Chapman, who is vice-president of the American Society for Testing Materials and chairman of the society's Committee C-9 on concrete and concrete aggregates, brought out the advantages of ready mixed concrete over job mixed concrete in the matter of appearance, durability and quality desired by the architect. He stated that the better control possible with this method of making concrete has unquestionably resulted in an improved product and that a large part of this improvement is the result of association activities.

Reliability of Producer an Important Factor

He pointed out that while the contractor is aware of the advantages of ready mixed concrete and its lower cost to him in many cases he is interested also in the manufacturer's reliability and ability to fulfill specifications and deliver uniform, workable concrete on schedule. The importance of reliable deliveries and the prevention of segregation during delivery was also brought out.

In the discussion which followed, **R. B. Young,** Ontario Ready Mix Concrete, Ltd., Toronto, Ontario, pointed out the danger of going too far along the line of selling on a strength basis alone where the concrete is to be exposed to the action of the weather. He stated that although concrete can be made more cheaply with a low cement content and still meet the strength requirements, its durability suffers and that durable concrete cannot be obtained on a 2000 lb. strength basis where the cement is cut down below the usual requirements.

THE CONVENTION of the National Ready Mixed Concrete Association was notable for the vigor with which it attacked the problems of the industry. As is apparent from the accompanying report, much interesting discussion followed the papers which were presented at the meeting. Much ground was covered that will add further to the stability of the industry.

Job Mixed Concrete a Competitor

Stanton Walker, director of engineering of the association, in discussing the matter stated that plant mixed concrete has the jump over job mixed concrete but requires study of the materials and the mixing. He also stated that job mixed concrete should be considered as a competitor the same as steel or other materials.

It was also brought out that for durability there must in all cases be enough paste to fill the voids even though the strength requirements are met by less cement and that although 2500 lb. concrete is good for structural frames, it should be on a strength basis of 3500 lb. when exposed.

H. F. Thomson, General Material Co., St. Louis, Mo., thought that too often the specifications were written without a full knowledge of the product and that further educational work is necessary as to just what concrete is and the higher strengths obtainable. He believes the higher strengths possible with modern mixing should be used and thus reduce the quantities required and that engineers and contractors should be convinced that reliable concretes of these higher strengths can be furnished. It was brought out also that considerable can be done by working through the building departments and through those who write the specifications.

Constant Check on Aggregate Gradation Should Be Maintained

Miles N. Clair, of the Thompson and Lichtner Co., consulting engineers, Boston, Mass., read a paper on "Control Tests of Ready Mixed Concrete." He stated that concrete must be uniform in quality and to get this there must be full control of both the quantity and quality of the materials used. The design of the plant is important in obtaining this accuracy and should have as completely as possible automatic equipment and be run by a good operator. He brought out the importance of a uniform grading of the aggregates and the prevention of segregation and stated that the gradation should be tested three times daily and the results plotted. Mixing should be by weight only and the scales tested monthly.

Mr. Clair recommended that complete records be kept on all mixes and results and that the operations be checked by outside inspections and tests. He considered high early strength cements dangerous and in support of this mentioned cases where test results showed decreased strengths with increasing age of the samples.

Those taking part in the discussion which followed disagreed with Mr. Clair's claim of a retrogression of strength with the use of high early strength cements. On the matter of segregation of the aggregates Mr. Goldbeck explained a simple device which has been used to prevent it in bins. This consists of a small hopper with four or five radiating chutes extending down into the bin and open on top. Mr. Goldbeck also thought that any lack of durability in concrete is caused not so much by the quantity of the cement used as by the use of too much water.

The opinion was expressed that the coarse aggregates should be separated into two or more sizes. Mr. Young, however, thought this unnecessary if the plant is properly laid out. He stated that he uses a slight excess, 2%, of sand to take care of variations in grading and to improve workability.

Purchase Specifications Under Discussion

At the afternoon session Mr. Young, who is chairman of the sub-committee of Committee C-9 of the A.S.T.M., now engaged in drawing up a purchase specification for ready-mixed concrete, outlined what has been done. The tentative draft of this will be sent out soon and he asked that all ready-mixed concrete manufacturers send in an expression of opinion and their criticisms on it. Among other things the specification as it now stands would allow a tolerance of 1 in. in the slump test for consistency. All materials except water are to be weighed and water is to be measured accurately within ½%. A minmum mixing time of 1 min. per cu. yd. capacity of mixer plus ½ min. for each extra yard capacity is stated. Agitation is called for on slumps above 2 to 2½ in. and it is proposed to increase the maximum delivery time from 1 hr to 1¼ or 1½ hr.

Mr. Clair stated that he expected some action on the A.C.I. specifications in about a month, but that on account of some rather wide divergence between the specifications of Mr. Young's committee and the A.C.I. he

would try and hold it over and reach some agreement.

A. T. Goldbeck of the Crushed Stone Association, read a paper on standard methods of testing concrete. He stated that the manner of making the tests is very important since the tests results vary considerably according to how this is done, hence details should be carefully followed. He is now working on a stability test in which the force necessary to push the blade down at the side of the mold would be a measure of the consistency and hopes to be able to develop a method which will give a better indication of consistency than the present slump test. The discussion brought out the wide difference in results from commercial testing laboratories and the need of more accurate work by them.

V. P. Ahearn, executive secretary of the association, reported on the activities of the executive personnel since taking up this work last April and urged more membership in order to properly carry on the association work.

Stanton Walker, director of engineering of the association, reported on the work of his department and also pointed out the desirability of a larger membership and more support for these activities.

The annual banquet, which was held Monday evening following the first day's session, was very well attended and was a very pleasurable affair.

The Irresponsible Operator

Tuesday an open forum was held during most of the day in lieu of any set program of papers and much interesting discussion developed. On the subject of the "Menace of the Irresponsible Operator," the discussion was led by Mr. Thomson, who considered unregulated expansion of production facilities a most serious problem. He considered that equipment manufacturers have definite responsibilities to prevent a too fast expansion and to not further a too promiscuous distribution of equipment in irresponsible hands. He urged that operators view the business as the merchandising of a superior building material and use their efforts to improve the building codes and educate users as to the superiority of controlled concrete, to the end that the industry may not fall into such difficulties as injured the concrete block industry.

The responsibility of each operator toward the others and of the manufacturers of equipment not to over-sell was further brought out. In this discussion it was brought out clearly by Mr. Burke and others that the association makes no discrimination between plant mixed and truck mixed concrete, both of which with proper control are superior to job mixed concrete.

Selling Ready Mixed Concrete

Sales methods were discussed by **Herbert J. Knopel** of the Warner Co., who considers that quality is a most important factor in selling. He broke down the cost of ready mixed concrete into its various items in order to show how necessary it is to sustain the prices of the dry materials used. In quoting prices, it was brought out that it is very important that the producer know the alternate costs of the contractor in mixing and placing concrete in order that he may not be competing with himself in the matter of the dry materials.

On the subject of the producer's relations with the dealer and manufacturer of cement, **J. L. Shiely,** who led the discussion, believed that the trend is toward the elimination of the dealer and buying direct from the mill. However, the discussion indicated that quite a number were of the opinion that the promotional work of the dealer's salesmen justified his place even though he might be considered by some as an unnecessary middleman. One point raised, however, was that the dealer who goes into the ready mixed concrete business has an unfair advantage in the matter of price differential unless the other producer can buy direct from the mill at the dealer's price.

QUALITY CONTROL of aggregates and the finished product, testing methods, association activities, responsibility of producers to consumers and to each other, selling methods, raw material purchases, plant operation, hauling problems and promotional methods all received deliberate consideration.

A discussion on plant operation was led by **A. C. Avril,** who believes that the most satisfactory way of handling coarse aggregates is in split sizes. He described his operation in Cincinnati where three sizes of coarse aggregate are used and are recombined to get a uniform straight line gradation. A four-compartment bin is used and the materials are reclaimed from storage piles by a belt conveyor. He considers this the best way because the temperature at the bottom of the pile is more constant and less heating of materials is required in winter operation. He believes also that the concrete bins which he uses have an insulating value over steel bins and help to reduce the amount of heating necessary.

In the discussion, Mr. Young said that he had found live steam to be the best method of heating aggregates under the conditions existing at his plants and that when properly used it caused very little variation in the moisture content of the aggregates (¼%). Pipes with hacksaw slots are used in storage piles and are so placed as to avoid any drainage to the reclaiming equipment. A number of railroad cars are also equipped with similar pipes around the lower edges of the car body and arranged for connection with a steam supply. In thawing out, the car is covered with a tarpaulin. Mr. Avril stated that he had been using similar pipe sections which can be laid across the top of the car.

Hauling Methods and Costs

Hauling methods were discussed by **Paul P. Bird** of the Boston Concrete Corp. He stated that strengths of concrete were the same or slightly greater for periods up to 2 hr. and that the slump decreased up to 1 hr. His experience was that the average cost of hauling was 86 c. per cu. yd. for an average distance of 4 mi. on 110,000 yd. of concrete, using Jaeger, open Blaw-Knox and Clinton bodies.

He told of using a new method of hauling bulk cement in a special trailer truck such as has been used at Detroit by the Huron Portland Cement Co. The trailer body holds 60 bbl. of cement and is arranged with 2 screw conveyors in the bottom. It can be loaded in 5 min., unloaded in 10 min., and makes the trip in ½ hr. He stated that it weighs 18,000 lb. and cost $5400.

In the discussion **Arthur A. Levison,** Blaw-Knox Co., observed that there seemed to be a trend toward a drum type body without hoist.

Education of Architects and Engineers

The matter of contacts with engineers and architects was discussed and it was believed that the association can do a lot in the way of familiarizing them with ready mixed concrete. According to Mr. Knopel the resistance of three or more years ago to the use of ready mixed concrete has been materially reduced and the Dunagan method of analyzing wet concrete has been helpful in showing the greater uniformity and better gradation of ready mixed concrete as against job mixed concrete.

Mr. Johnson, of the department of public works, Pittsburgh, stated that ready mixed concrete was being used on 50% of the concrete bridge work in Pittsburgh and that it has proven more uniform and of better quality as a result of the more accurate proportioning and better care in its preparation. He believes the association could do much good in spreading information as to its advantages.

S. Stepanian suggested that an advance might be made in control and quality of finished work by going a step farther and placing the concrete in forms which would be built by a separate but affiliated contracting company.

Following this discussion and just previous to adjournment of the convention Mr. Burke outlined the plans which had been formulated by the executive

committee as a basis for membership fees. These annual fees or dues range from a minimum of $50 to a maximum of $300 per member company and amount in any given case to a rate of 3 mills per cu. yd. on annual production of 100,000 cu. yd. or less.

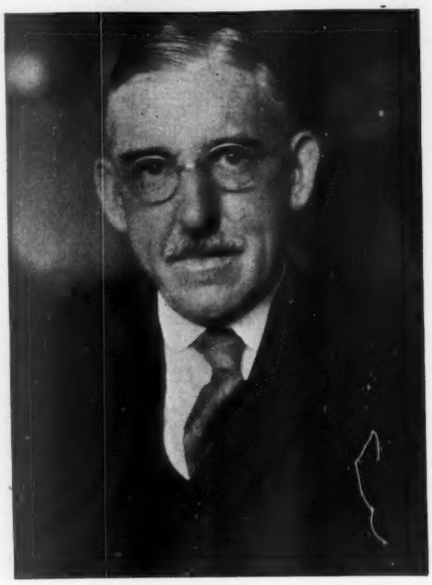
The following officers were elected for the ensuing year: J. E. Burke, Ready Mixed Concrete Co., Pittsburgh, Penn., president; Paul P. Bird, Boston Concrete Corp., Boston, Mass., H. F. Thomson, General Material Co., St. Louis, Mo., and R. B. Young, Ontario Ready Mix Concrete, Ltd., Toronto, Ontario, vice-presidents; Arthur C. Avril, Avril Tru-Batch Concrete, Inc., Cincinnati, Ohio, secretary; J. L. Shiely, Guaranteed Concrete Co., St. Paul, Minn., treasurer; Alexander Foster, Jr., Warner Co., Philadelphia, Penn., assistant treasurer; V. P. Ahearn, Washington, D. C., executive secretary; and Stanton Walker, Washington, D. C., director of engineering.

Registration—Producers

Arrow Sand and Gravel Co.; S. Stepanian, Columbus, Ohio.
Avril Tru-Batch Concrete, Inc.; Arthur C. Avril, Cincinnati, Ohio.
Bernard Ready Mixed Concrete Co.; J. L. Bernard, W. R. Nece, Washington, D. C.
Boston Concrete Corp.; Paul P. Bird, Boston, Mass.
Certified Concrete Co.; B. S. Andrus, St. Paul, Minn.
Cincinnati Builders Supply Co.; J. J. Warner, Cincinnati, Ohio.
Crown Paving and Construction Co., Ltd.; Emil Skarin, Edmonton, Canada.
Cherokee Concrete Co.; Chas. H. Fonde, Knoxville, Tenn.
John P. Callaghan, Inc.; P. P. Franjiane, Newark, N. J.
Detroit Transit Mixed Concrete Co.; J. K. Wing, Detroit, Mich.
Chas. H. Fry Construction Co.; H. N. Chapman, Erie, Penn.
General Material Co.; Karl W. Lick, H. F. Thomson, St. Louis, Mo.
Gravel Products Corp.; E. M. Hammond, Buffalo, N. Y.
Hamilton Builders Supply Co.; Chas. Lewis, A. V. Smith, Hamilton, Ontario, Canada.
Kuhlman Builders Supply Co.; E. H. Kuhlman, Toledo, Ohio.
Geo. Lanz and Sons, Inc.; Thomas C. Lanz, W. L. Stanley, Pittsburgh, Penn.
Loizeaux Builders Supply Co.; O. M. E. Dankel, Elizabeth, N. J.
McCrady-Rodgers Co.; Phil K. Rodgers, D. R. Cullison, Pittsburgh, Penn.
McElwee and Rogy, Inc.; J. F. McElwee, Jr., Peoria, Ill.
Metropolitan Concrete Co.; W. H. Crangle, Cleveland, Ohio.
Ontario Ready Mixed Concrete Co.; R. B. Young, Toronto, Ontario, Canada.
Pioneer Sand and Gravel Co.; L. A. Perry, Seattle, Wash.
Providence Transit Concrete Corp.; R. F. Moyer, Providence, R. I.
Ready Mixed Concrete Co.; F. J. Miller, Covington, Ky.
Ready Mixed Concrete Co.; Harry G. Riblet, Erie, Penn.
Ready Mixed Concrete Co.; A. W. Bliss, J. E. Burke, H. S. Davison, Pittsburgh, Penn.
Ready Mixed Concrete Corp.; L. G. Thom, B. C. Rolfe, Richmond, Va.
Scranton Ready Mixed Concrete Co.; Arthur Caldwell, Edward Gogolin, Scranton, Penn.
J. L. Shiely Co.; J. L. Shiely, St. Paul, Minn.
Superior Ready Mixed Concrete Co.; Walter E. Howard, Cincinnati, Ohio.
Transit Mixers, Inc.; George C. Ellis, R. McLean, Dunellen, N. J.
Warner Co.; Alexander Foster, Jr., Herbert J. Knopel, Philadelphia, Penn.
Whittemore Co.; Myron A. Howe, R. S. McSorley, Boston, Mass.
Wyoming Valley Ready Mixed Concrete Co.; Robert Rosser, Wilkes-Barre, Penn.
York Concrete Co.; L. H. Gross, B. W. Whitman, York, Penn.

Made Honorary Member of Sand and Gravel Association

A REMARKABLE TRIBUTE to the love and admiration with which members of the National Sand and Gravel Association regard Edmund Shaw, contributing editor of



Edmund Shaw

Rock Products, was the action of the convention at Pittsburgh, January 28, electing him an honorary member. He is the *first* and for the time being anyhow, the *only* honorary member of the association.

Form Ohio Association to Promote Concrete Roads

THE newly organized Ohio Concrete Pavement Association, composed of nearly 100 of the largest road contracting firms and allied interests, went on record unanimously against future subsidizing of road materials in highway construction within the borders of that state.

This recently organized group represents an industry with an investment of $1,350,000,000 and 95,000 employes. Its president is Fred I. Rowe, of the Johnson Construction Co. of Hicksville, O. Other officers are: first vice-president, John F. Stambaugh, Ada; second vice-president, B. C. Birody of the Truscon Steel Co., Youngstown; secretary and treasurer, R. S. Frame, Jr., of the American Aggregates Corp.

Mr. Rowe, in a terse statement, makes no effort to hide the fact that the newly organized association is for the purpose of promoting the use of concrete in all future highway projects, based solely upon economy.

According to the *Columbus* (Ohio) *Dispatch*, Mr. Rowe revealed that a committee held a conference with Governor White, who gave assurance the administration would construct more miles of concrete in 1932 than was constructed during 1931.

To Manage Pacific Division of Asphalt Institute

THE ASPHALT INSTITUTE, New York, N. Y., through the managing committee, Pacific Coast division, announces the appointment of Daniel B. Miller, as managing engineer, in charge of activities on the Pacific Coast. Western offices for the Asphalt Institute have been opened by Mr. Miller at 206 Sansome St., San Francisco. B. E. Gray, highway engineer at the main offices of the institute in New York, is now in San Francisco where, with Mr. Miller, he is organizing the work of the Pacific Coast division and coordinating it with that of the main office.

Mr. Miller is well known on the Pacific Coast where, since 1923, he has been associated in an engineering advisory capacity with several of the larger surety companies operating in this territory. He is also prominent in military circles in connection with his duties as a lieutenant colonel of the U. S. Army Infantry Reserve. For the six years prior to his military services he was connected with the asphalt industry at Washington, D. C.

New Pavement Awards in 1931

CONCRETE PAVEMENT yardage awarded in the United States during the month of December, divided according to roads, streets and alleys, as reported by the Portland Cement Association, and the totals for the 12 months' period ending December 31, 1931, are:

	Yardage awarded during December, 1931	Yardage awarded to date, December 31, 1931
Roads	4,215,154	111,853,352
Streets	1,034,252	21,729,115
Alleys	114,735	906,356
Total	5,364,141	134,488,823

Comparing awards for concrete highway construction, during 1931 awards showed an increase of about 3.5% over 1930; and municipal awards for street and alley construction a drop of approximately 40%. Total highway, street and alley paving awards showed a decline of about 7.8% from 1930.

New Market for Beryllium

ACCORDING to G. C. Riddell and Donald M. Liddell, co-authors of a review article on the rare metal developments in 1931, which appeared in *Mining and Metallurgy* recently, an important use for beryllium has been developed as the facing of cathodes of neon lamps for monochromatic television. Small pieces of beryllium are welded to a tungsten heater, which is placed in a vacuum chamber together with the cathode to be coated. On heating in a high vacuum the beryllium melts and slowly vaporizes, the vapors condensing on the cathode, which is later mounted in the lamp.

Four Companies Bid Jointly on Cement for Hoover Dam

FOUR southern California cement companies have submitted the low bid for 380,000 bbl. of cement to be used for lining the diversion tunnels at Boulder dam to the United States reclamation bureau at Denver. Their bid was $2.22 per bbl., the next lowest being $2.39.

It was stated the companies united in the bid in order to insure increased employment for their workers. They are the Riverside Portland Cement Co., California Cement Co., Monolith Cement Co., and Southwestern Cement Co., the *Los Angeles* (Calif.) *Herald-Express* reports.

Cement bids were called unexpectedly late in December, when it was announced that contractors building Hoover Dam are nearly a year ahead in their construction program and that the four diversion tunnels are nearing completion. The 380,000 bbl. of cement called for will be used during 1932.

In an explanatory letter accompanying their bid the southern California group stated that in submitting a joint bid they had "mutually agreed to divide the responsibilities involved in proportions roughly corresponding to the capacities of their several plants." The companies also agreed to make themselves jointly and severally responsible for the faithful performance and completion of the contract, according to the *Los Angeles* (Calif.) *Times*.

New Cement Bids Submitted

BIDS FOR 2,000,000 bbl. of cement for use in 1932 were received January 21 by the Indiana state highway department for the second time. The bids received were approximately 30c. a bbl. less than those received some time ago. According to John J. Brown, the new bids will mean a reduction of approximately $500,000, if accepted. The first proposals were rejected when lower prices were quoted to the Illinois highway department. Seventeen companies offered bids.—*Indianapolis* (Ind.) *News*.

Walter F. Jahncke Honored by Norway's King

WALTER E. JAHNCKE, vice-president of Jahncke Service, Inc., New Orleans, La., and vice-consul of Norway for Louisiana, has received the diploma of knight of the first class of the Royal Norwegian Order of St. Olaf. The honor was ordered by King Haakon VII of Norway.

Word of the new honor to be bestowed on him reached Mr. Jahncke December 3, but it was not until January 9 that he received the official royal diploma and the decorations of the office. As an insignia of his knighthood the vice-consul was presented with the St. Olaf cross, which is gold and white and bears the Norwegian coat of arms and the words "Justice and Truth."

Mr. Jahncke was decorated for promoting good will and better understanding between Norway and the South, according to Harold Werner, native Norwegian and consulate secretary, and for interest taken in the Norwegian colony in New Orleans.

"Mr. Jahncke has done everything in his power to help the Norwegian colony in New Orleans and has contributed generously towards improvements," Mr. Werner said.

It is very unusual, Mr. Werner pointed out, for an American who has only served as vice-consul for seven years to be made a knight of the first class.

Reports Perfect Safety Record for 1931

THE Coplay Cement Manufacturing Co., Coplay, Penn., manufacturers of Saylor's portland cement since 1866, has been added to the list of plants operating its mills and quarries through the year 1931 without a single lost-time accident. This company has now operated 534 successive days without any serious accidents, and is striving hard to improve this record during the current year. Its officers and employes are affiliated with the various safety organizations, local and national, and doing their part in the development of safety first work in industry.

To Resurface Brick Pavement with Concrete

THE OHIO state highway department has announced its decision to resurface with concrete seven miles of brick paving on state route No. 3, the *Sandusky* (Ohio) *Register* reports.

In 23 days there were 35 crashes on the highway because of autos skidding on the slippery tar filler between the bricks in wet weather. For safety's sake the entire stretch of brick paving will be resurfaced with concrete, similar to that which was done on a four-mile stretch of No. 20 between Monroeville and Bellevue, the report states.

Many Private Pits Compete on County Gravel Bidding

COUNTY commissioners received 30 bids for gravel to be used on the county highways, at a recent meeting in Covington, Ind. Most of the bids came from private pits. The Neal Gravel Co., and the Interstate Gravel Co. were the only bidders submitting prices on commercial gravel and sand.

All prices were much lower than what has been formerly paid.—*Covington* (Ind.) *Friend*.

Illinois Awards Cement Contracts

ANNOUNCEMENT of rejection of bids on 3,439,000 bbl. of cement and of contract awards on 1,561,000 bbl. was made January 22 by the Illinois state highway department.

Cement purchased was obtained at 30c a barrel less than a year ago, bringing the price to the lowest in history of state road construction, according to Chief Highway Engineer Sheets.

The successful bidders and amounts follow: Alpha Portland Cement Co., 1,300,000 bbl.; Dewey Portland Cement Co., 122,000 bbl.; Missouri Portland Cement Co., 139,000 bbl.—*Chicago* (Ill.) *Daily News*.

RETAIL MATERIAL PRICES, DELIVERED, DECEMBER 1, 1931 (COMPILED BY DEPARTMENT OF COMMERCE)

City	Portland cement, per bbl. exclu. of cont.	Gypsum wallboard, ⅜-in., per M	Hydrated lime, per ton	Building sand, per cu. yd.	Crushed stone, ¾-in., per ton	Gypsum plaster, neat, per ton
New Haven, Conn.	$2.40	.....	$15.00	$1.50	$2.00	.....
New London, Conn.	2.60	25.00	18.00	1.50	3.00	$18.00
Waterbury, Conn.	2.60	30.00	20.00	1.25	2.45	20.00
Haverhill, Mass.	2.32	25.00	20.00	.....	.....	18.50
New Bedford, Mass.	2.40	24.00	16.50	1.50	2.75	16.50
Albany, N. Y.	2.34	23.85	15.75	.....	.....	16.20
Buffalo, N. Y.	2.95	21.00	18.00	2.50	2.05	16.00
Poughkeepsie, N. Y.	1.95	.....	26.00	2.25	2.20	13.00
Rochester, N. Y.	2.28	22.00	20.00	2.25	2.40	16.00
Paterson, N. J.	2.00	24.00	18.00	1.50	2.10	17.50
Trenton, N. J.	2.20	24.00	17.00	.95	1.85	17.00
Erie, Penn.	2.10	22.50	16.00	2.00	.....	16.00
Philadelphia, Penn.	2.10	.....	13.75	1.75	2.60	17.50
Scranton, Penn.	2.40	.....	20.00	3.25	.....	19.00
Baltimore, Md.	2.10	25.00	13.00	1.85	2.50	14.50
Washington, D. C.	1.65	25.00	12.00	.....	.....	14.00
Richmond, Va.	3.10	31.00	17.50	1.95	2.45	20.00
Fairmont, W. Va.	2.75	35.00	16.00	2.80	3.50	18.00
Columbia, S. C.	2.28	35.00	11.00	1.50	2.60	15.40
Atlanta, Ga.	2.40	.....	15.00	2.81	2.50	19.75
Savannah, Ga.	2.25	25.00	20.00	1.75	.....	16.00
Tampa, Fla.	2.60	.....	24.00	2.75	2.80	.....
New Orleans, La.	2.20	.....	13.00	1.85	.....	18.00
Akron, Ohio	$1.74	.....	$12.00	$1.50	$2.50	$14.00
Cincinnati, Ohio	1.94	22.75	14.40	2.63	2.55	.....
Cleveland, Ohio	1.68	.....	10.00	1.69	2.15	15.00
Columbus, Ohio	2.35	.....	12.00	1.50	2.75	14.40
Toledo, Ohio	1.40	21.00	14.00	1.60	1.75	14.00
Youngstown, Ohio	2.43	23.25	16.00	2.50	2.50	18.00
Lansing, Mich.	2.25	.....	20.00	1.80	1.80	17.50
Terre Haute, Ind.	2.00	28.00	18.00	1.25	3.00	18.00
Louisville, Ky.	1.86	.....	15.00	2.00	2.15	17.00
Milwaukee, Wis.	1.25	22.00	.....	1.25	1.25	15.20
Des Moines, Iowa	1.82	23.50	18.00	1.40	4.15	14.00
Kansas City, Mo.	1.68	25.00	24.00	1.60	2.25	15.00
St. Louis, Mo.	.....	.....	16.00	1.35	1.30	16.00
St. Paul, Minn.	2.15	21.00	19.00	1.25	1.75	17.00
Grand Forks, N. D.	2.60	.....	16.25	2.60	.....	18.75
Sioux Falls, S. D.	2.00	40.00	22.00	1.25	2.25	15.00
Tulsa, Okla.	1.90	22.50	22.50	.85	2.35	16.00
San Antonio, Tex.	2.42	42.00	20.00	2.25	2.35	17.00
Tucson, Ariz.	3.45	45.00	30.00	1.25	2.25	17.10
Los Angeles, Calif.	2.30	23.50	24.70	1.85	1.90	15.20
San Francisco, Calif.	.....	45.00	22.50	1.40	1.60	16.90
Seattle, Wash.	2.40	35.00	22.00	1.40	1.50	18.00

New Machinery and Equipment

Aluminum Booms for Draglines

DURING JANUARY, 1931, a dragline with a 75-ft. aluminum alloy boom and 1½-yd. bucket was put into operation at an anthracite stripping operation. This aluminum alloy boom is said to be the first of this

First aluminum alloy boom made by excavating machinery manufacturer

metal to be manufactured by an excavating machinery company and placed in regular service, and was made by the Bucyrus-Erie Co., South Milwaukee, Wis. Since installation it is said the boom has proved entirely satisfactory in all respects.

Its unusual feature is, of course, its light weight, which is only two-thirds that of a steel boom. This makes possible securing a longer reach with standard bucket sizes or using standard boom lengths with an increase in bucket size, the manufacturer states.

The Bucyrus-Erie Co. states it has applied this type of boom to several other installations up to 175 ft. in length, upon all of which it has most definitely proved its advantages. This manufacturer now offers to the industry aluminum alloy booms for any size dragline.

•

Containers for Pulverized Materials

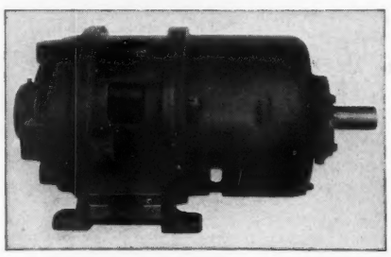
THE INCREASING AMOUNT of bulk shipments of pulverized materials has created the need of containers which can be fitted to standard railroad cars or motor trucks. To meet this demand the Kennedy-Van Saun Manufacturing and Engineering Co., New York, N. Y., has developed a container which may be used for cement, pulverized fuel, or like shipments. The containers are welded steel tanks fitted with connections for applying the Kennedy pneumatic transport system. They may be filled either by gravity or by transport system at the point where the material is pulverized, then transported by rail, boat or motor to the point where the material is to be used, where they may be used as storage bins or may be discharged pneumatically into a permanent storage bin.

•

Unit-Built Motors and Speed Reducers

AN ARRANGEMENT for powering various motor-driven equipment which operates at reduced motor speeds is afforded by new unit drives now available from the Westinghouse Electric and Manufacturing Co., Pittsburgh, Penn.

These new drives, which are known as Gearmotors, consist of speed reducers combined with motors forming self-contained units only a few inches longer overall than motors alone. Prominent advantages claimed for this combination of power and speed reducing equipment include economy in space requirements, easy and simplified installation,



Speed reducer combined with motor forms compact, self-contained unit

reduced number of drive parts, efficiency of operation, and low maintenance requirements.

Each unit includes a Westinghouse type CS general purpose induction motor and a double reduction, non-planetary type helical gear speed reducer built on to the one-piece motor frame, forming an assembly which is supported entirely by the motor feet.

An improvement in motor construction incorporated in these unit drives is the prewound primary core which is separable from the stator frame. This feature permits quick and inexpensive change of motor speed, voltage and phase, the manufacturer states.

All gear and pinion shafts are supported on roller bearings. By a splash system of lubrication all moving parts of the speed reducing mechanism and one motor bearing receive oil continuously during operation. The other motor bearing is packed with grease.

Ventilating air for the motor is taken in through an opening in the lower section of speed reducer housing and directed by a curved shield integral with the interior of the housing.

Gearmotors are built in sizes of ½ to 15 hp., with a wide selection of output ranging from 69 to 1550 r.p.m.

•

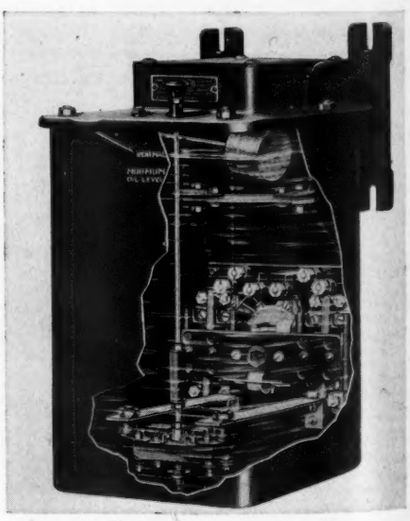
Explosion-Proof Starter

A NEW across-the-line, automatic starter for alternating current squirrel cage induction motors, that is claimed to be explosion proof, is announced by Cutler-Hammer, Inc., Milwaukee, Wis.

This new starter is said to differ from the usual immersed oil dashpot relay and three-pole magnetic contactor in that a newly designed thermal overload mechanism is used with the contactor.

According to the manufacturer, the new starter is designed in keeping with the latest requirements of the Underwriters Laboratories for Class 1, Group D, Hazardous Locations. Briefly, this includes such installations where gasoline, alcohol, etc., are present in the atmosphere.

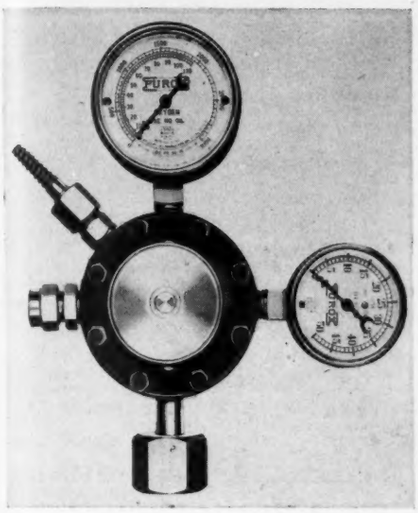
Being completely oil immersed, the starter is corrosion resisting and is said to be suitable for chemical plants and cement mills.



Explosion-proof starter protected against corrosion by immersion in oil

Welding and Cutting Regulators

THE Linde Air Products Co., New York, N. Y., has recently introduced an entire series of new and improved Purox oxygen and acetylene regulators, superseding its former line of Purox Metal Master type of regulators. All Purox welding or cutting outfits now include these new regulators



A new type of oxygen and acetylene regulator with self-aligning valve

where formerly Metal Master regulators were supplied as part of the regular equipment.

According to the manufacturer, one of the outstanding design features of the new regulators is an accurate self-aligning valve of the nozzle and yoke type, insuring sensitive action and freedom from leakage. Simplicity of construction is said to eliminate any need of disturbing the diaphragm, bonnet, pressure adjusting screw or pressure adjusting spring when replacing a worn valve seat. Access to the interior of the regulator is gained by removing a plug in the rear of the body. The seats are made of a material not easily marred, scratched or damaged by foreign particles that might find their way into the inside of the regulator.

Purox regulators are listed as standard by the Underwriters' Laboratories and the Factory Mutuals Laboratories, the manufacturer states.

•

Announce Consolidation

THE Babcock and Wilcox Co., New York N. Y., announces a further consolidation of the resources and facilities of the Babcock and Wilcox and the Fuller Lehigh organizations, effective January 1. The sales offices of the two companies have been combined and all business heretofore carried on separately or jointly by these companies will be done in the name of the Babcock and Wilcox Co. through its district sales offices, the announcement states.

As part of a program whereby the Babcock and Wilcox Co. is able to furnish any equipment which might be required to burn fuel and generate steam efficiently and economically, the company purchased in 1926 the Fuller Lehigh Co., manufacturers of pulverized fuel equipment, and to this line was added Bailey furnace walls, formerly manufactured and sold by the Bailey Meter Co.

This latest consolidation will, the company states, result in a better and more efficient sales service to the customers of both organizations and others with whom the company does business.

•

Alloy Steel

THE Electro Metallurgical Co., New York, N. Y., announces it has developed a series of low-alloy steels containing chromium, manganese and silicon. These new alloy steels have been introduced under the name of cromansil steels, a general term used to designate all steels whose composition comes within the recommended range of alloy content.

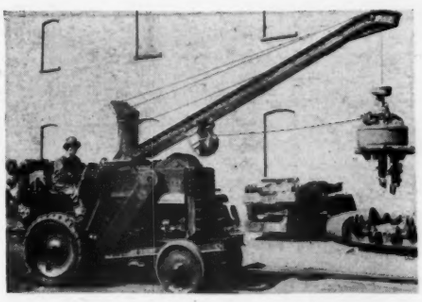
The most useful forms of cromansil steel are said to contain from 0.4 to 0.6% chromium, 1.1 to 1.4% manganese, and 0.7 and 0.8% silicon, with a carbon content ranging from less than 0.10 to 0.65%, depending upon the particular use to which the steel is to be put. It is said the presence of these three elements in combination results in high ultimate strength, great ductility, high fatigue limit, high impact strength, and ready machinability. Another important effect is said to be the increase in latitude of allowable finishing temperature of rolling.

The Electro Metallurgical Co. states that cromansil steels can be made by any skilled steel maker without additional experience or training, and can be produced in the open hearth at a slight increase in cost.

•

Portable Crane Equipped with Magnet

THE "Loadmaster," manufactured by Bucyrus-Erie Co., South Milwaukee, Wis., and mounted on either wheels or crawlers, may now be obtained equipped with 20-in. Ohio magnet, it is announced. This magnet equipment makes the machines useful for handling small castings which ordinarily require considerable time for hooking. Power is supplied to the magnet by a 2-kw. Kohler electric plant, mounted on the truck frame of the portable crane equipment.



By equipping this machine with a magnet, handling of castings is facilitated

•

Announces Lower Prices on Speed Reducers

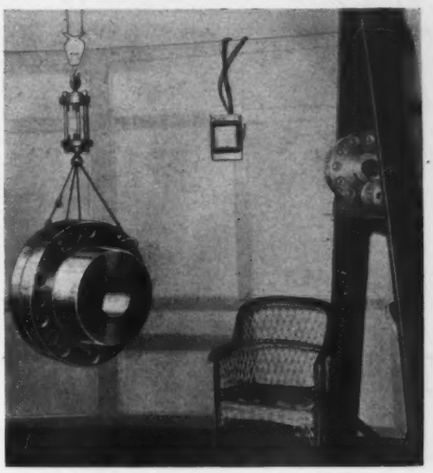
A LOWER SCHEDULE of prices on various types and sizes of speed reducers has been announced by the Falk Corp., Milwaukee, Wis.

Falk standard speed reducers are made in single, double and triple reductions, both horizontal and vertical, for parallel shaft and right angle drives. There are 17 types in 202 sizes, ranging from 1000 hp. down to 0.05 hp., with 133 standard ratios from 1.5 : 1 to 518 : 1.

•

Flexible Coupling Test

THE Ajax Flexible Coupling Co., Westfield, N. Y., conducted an unusual and interesting test at the national convention of



Interesting test designed to show the merits of this flexible coupling

Iron and Steel Engineers at Cleveland in June.

A steel frame was set up and a large 10-in. bore, 2100-lb. coupling was suspended by three rods inserted through the pin holes in the two flanges of a small 1⅜-in. bore coupling. The unit was then connected to a hoist which brought direct shock and pressure to bear on the rubber bumpers of the company.

According to the manufacturer, under no service conditions is the coupling subject to any great fraction of the direct pull which it received in this test as the free floating pins limit the load in service to compression and expansion, and in this test there was a dead weight tending to drag the rubbers out of the holes.

News of All the Industry

Incorporations

Malvern Gravel Co., Wilmington, Del., $30,000.

Fletcher Limestone Co., Fletcher, N. C. To operate stone crushing plant.

Baker Gravel Co., Sidney, Ohio, $500. O. A. Baker, J. C. McKee and W. E. Baumgardner.

Battle Creek Sand and Gravel Co., Battle Creek, Mich., $15,000.

Century Masonry Cement Co., Wilmington, Del., 22,000 shares common.

Russia Cement Co., incorporated in Massachusetts, $75,000.

Green County Limestone Co., Green County, Va., increased capital from $25,000 to $200,000.

Lane Sand and Gravel Co., Eugene, Ore., $75,000.

Johnson-March Corp., Great Neck, N. Y., $100,000 and 5000 shares common. To produce concrete blocks.

Knoxville Crushed Stone Co., 422 Front St., Knoxville, Tenn., $10,000. A. H. Whisman, W. E. Johnson and W. K. Johnson.

Rockydale Quarries Corp., Roanoke, Va., $50,000. C. E. Hunter, president, Mountain Trust Bldg., Roanoke, Va.

Highway Sand and Gravel Corp., 1449 Broadway, New York City, N. Y., $20,000 preferred and 800 shares common. J. Atz.

Ozark Mineral Production Co., Inc., Little Rock, Ark. W. W. Finley and M. H. Gazette, 2807 Marshall St., Little Rock, Ark.

Belton Sand and Gravel Co., Belton, Tex., $5000. Burrell McInerney, Kathleen McInerney and Elmer H. Hays, all of Dallas.

Cle Elum Sand and Gravel Co., Inc., Cle Elum, Wash., $25,000. M. M. Hertrick, Frances S. Malloy and E. E. Flood.

Auburn Sand and Gravel Co., Inc., Worcester, Mass., 500 shares of no par value. Samuel J. Kattor, president and treasurer, 5 Hyannis Place, Worcester, and Mary and Joseph S. Kattor.

John J. Carroll and Sons, Naugatuck, Conn., $50,000, divided into 500 shares of $100 each. Delia Carroll, John J. Carroll, Louis Carroll, J. T. Carroll and D. A. Carroll, all of Naugatuck. To deal in sand and gravel.

St. Maurice Quarry, Ltd., Three Rivers, Que., Canada, $149,900, consisting of 1499 shares, par value $100 each. B. J. Trepanier, L. R. Richer and H. Ferron, Three Rivers, Que. To operate stone and granite quarries.

Canada Chalk Co., Ltd., Toronto, Ont., Canada, 40,000 no par value shares. William Yerex, sales manager, and Arthur G. Cropp, both of Toronto, Ont., Canada. To manufacture and deal in chalk, limestone, gypsum, carbonate of lime, etc.

Southern Silica Co., Etowah, Tenn., 5000 shares, par value $100 per share. John Reed, president; E. M. Shelley, vice-president; O. L. Reed, secretary and treasurer; J. D. Parks, general superintendent; J. B. Carper, sales manager and consulting engineer.

National Granite Works, Ltd., Montreal, Que., Canada, $100,000, consisting of 1000 shares, par value $100 each. Adrian Knatchbull-Hugessen, Hamilton L. Smith and Edmond J. Eberts. To produce stone, marble, granite, gravel, sand, lime, etc.

Montreal Dunbrick, Ltd., Montreal, Que., Canada, 350 preferred shares, par value $100 each, and 1500 common shares of no par value. Joseph W. Weldon, Westmount, Que., and Alec P. Gregg, Montreal, Que. To manufacture cement brick, tile, blocks and other cement products.

Ottawa Silica and Sandstone, Ltd., East Templeton, Que., Canada, 2000 shares of preferred stock, par value $100 each, and 2000 shares common of no par value. Arthur Ellis and Sydwell A. V. Martin of Ottawa, Ont., Canada. To produce stone, sand, gravel, cement, feldspar and building materials.

Quarries

W. N. Lance, Fletcher, N. C., is reported to be installing machinery for crushing stone.

Marshall, Mo. Rock quarry north of Slater was reopened January 3. Effort is being made to load barges while water is still at a high stage.

Rhinelander, Wis. The city is preparing to install a limestone pulverizer at its crushing plant and will ask $1.50 per ton at the bin.

Edward Johnson, 9750 Otsego Ave., Van Nuys, Calif., has been given permit to build $15,000 rock crusher plant.

Caldwell, Ohio. Six or seven stone quarries have been opened in Noble county to help the unemployment situation.

Somerset, Ky. State-owned limestone crusher furnished 6500 tons of limestone to 144 Allen county farms in 1931.

Cleveland Quarries Co., Cleveland, Ohio, re-elected the same officers and directors at its annual meeting, January 13.

L. W. Lewis Sons, who for many years have operated the stone quarry near Augusta, Kan., are moving their equipment to Garnett and henceforth will operate in that territory.

Ouachita Quarries, Little Rock, Ark., has secured over 1500 acres of stone properties in Montgomery county. It plans installation of quarrying, conveying and other equipment.

Oshkosh, Wis. County stone crusher has been moved into the quarry in Algoma to provide work for unemployment relief. Stone will be crushed for town road improvement work during 1932.

H. E. Drake, Visalia, Calif., is developing limestone deposits in the Sierra Nevada mountains close to King river. Fifteen men are now working the deposit and it is being marketed for agricultural purposes at $1.00 per ton.

B. B. and P. C. Fussell, Jacksonville, Fla., are building a rock crushing plant in Gainesville. Machinery and equipment for the plant will be brought from Emalthe where they formerly operated a plant.

Fred A. Wilson, Atlanta, Ga., is now erecting a cold mix asphalt plant at the Ladd Lime and Stone Co. quarry, Cartersville. A railroad siding has been installed to his plant, as well as machinery.

California Rock Co., Upland, Calif., has leased 20 acres of ground and is erecting rock crushing plant estimated to cost $10,500. F. B. Holiday, president, reports operation will start about February 1.

Breckenridge, Mo. The mayor has received an order from the company which is building an ice plant in Chillicothe for 400 tons of crushed rock. The quarry men are paid 50c a cu. yd. and earn from $2.50 to $4.00 per day in the municipal quarry.

American Black Marble Corp., a Kansas City, Mo., company, recently organized, which claims to control the only known commercial quarry of black marble outside of Belgium, has leased space in Kansas City for offices and display. Its quarries are in central Arkansas in Stone and Searcy counties.

F. M. Secrest, formerly of Kansas City, is developing an extensive deposit of marl lime in Fresno, Calif. The product will be marketed for agricultural use and is said to contain 85.42% calcium carbonate. The deposit is reported as from 4 to 11 ft. thick. The company will operate under the name of Coral Reef Lime Co.

Laura Gravel and Stone Co., Brookville, Ohio, elected Edward Mattis president, Robert Kraus vice-president, and I. E. Baker secretary-treasurer, at its 14th annual stockholders' meeting. The company has been awarded contracts to allow a steady production of at least three months, it was stated.

Fort Flowers, president, National Lime and Stone Co., Carey, Ohio, has issued notice that the Commerce Guardian Bank, Toledo, has been appointed trustee under the first mortgages or deeds of trust of the National Quarries Co. and the National Lime and Stone Co., dated respectively March 1, 1926, and July 1, 1926.

Sand and Gravel

R. H. Eastwood Sand and Gravel Co., Graysville, Ill., has installed a new steel bin at its plant.

Maxwell Gravel Co., Indianapolis, Ind., has filed application for final dissolution, it is reported.

Baker Gravel Co., Noblesville, Ind., and its new sand and gravel plant, were recently described in the *Noblesville Ledger*.

Zanesville Sand Co., Zanesville, Ohio, has discontinued operation of its Rush Run and McCluney plants. Its address is box 624.

J. B. Blanton Co., Frankfort, Ky., and its operations in Frankfort was recently described in the *Kosmos Cement News*.

Service Gravel Co., Riverside, Calif., has been granted a five-year lease on a city lot for gravel storage.

Columbia Sand and Gravel Co., Middletown, Ohio, has had its receivership lifted as a result of satisfying the judgment of Malissa Miller.

Terre Haute, Ind. The county commissioners ordered operation of gravel plant and dragline near Bloomfield discontinued.

Seattle, Wash. Lewis county commissioners are reported to have purchased 3.9 acres of land to open up a gravel pit.

Colonial Sand and Stone Co., New York, N. Y., has leased ground from the Sier-Bath Co. at 640-48 W. 58th St.

Air City Gravel Co., Dayton, Ohio, is defendant in suit for judgment and receivership has been asked by C. J. Beuker, it is reported.

Brown-Huffstetter Sand Co., Indianapolis, Ind., has filed application of preliminary dissolution, it is reported.

Lancaster Coal and Sand Co., New Lexington, Ohio, had its $140,000 plant completely destroyed by fire January 10.

Ward Sand and Gravel Co., Oxford, Mich., is reported to have lost its supply house by fire believed to have started from sparks from a stove.

Lane Sand and Gravel Co., Eugene, Ore., has completed installation of screens in its plant. C. M. Igoe, manager, states firm is about ready to complete articles of incorporation.

Rock Island Sand and Gravel Co., Rock Island, Ill., reelected all former members of the board and the board reelected the same officers of the company at its annual meeting of stockholders recently.

Hillside Washed Sand and Gravel Co., Milwaukee, Wis., are defendants in a petition in involuntary bankruptcy filed in Federal Court, January 19, it is reported.

Fond du Lac, Wis. Opening of a new gravel pit by city was recommended by street department to the council recently because present pit is reported to be difficult to reach in wet weather.

New York Sand, Stone and Gravel Co., Scranton, Penn., is reported to have filed a petition for dissolution of corporation. Court hearing fixed for February 3.

Poynette, Wis. Village is attempting to recover 53,240 cu. yd. of gravel from Columbia county which it claims was taken from the village pit by employes of the county highway department.

Kickapoo Sand and Gravel Co., Peru, Ind., has salvaged its steel dredge which sank early in the fall and the boat will undergo a complete overhauling so that it may be placed in service as soon as possible.

Pittsburgh Gravel Co., Pittsburgh, Penn., has purchased the Diesel engine towboat *Reliance* to replace one recently destroyed by fire. The *Reliance* is 75 ft. long, 18 ft. wide and 42 in. deep and is equipped with a 180-hp. engine.

Foley Bros., contracting firm of St. Paul, Minn., has submitted proposal to open gravel pit in Nicollet county fair grounds. The proposal is said to be as follows: Down payment of $3500 and royalty of 10c. per cu. yd. for all gravel removed. It is reported directors are awaiting other offers. It is also reported that Foley Brothers have acquired options on other nearby property.

Cement

Pennsylvania-Dixie Cement Corp. has purchased additional rock deposits near Winterset, Ia.

Standard Portland Cement Co., Painesville, Ohio, reports that it had no lost-time accidents in 1931.

Aetna-Portland Cement Co., Detroit, Mich., is reported to plan expansion of its Essexville plant.

Lehigh Portland Cement Co. reopened its Mitchell plant January 4.

Lone Star Cement Co. of Alabama announces the appointment of Lewis Lloyd as sales manager.

Standard Portland Cement Co. and the Diamond Alkali Co., recently contributed cement for a high school stadium at Painesville, Ohio.

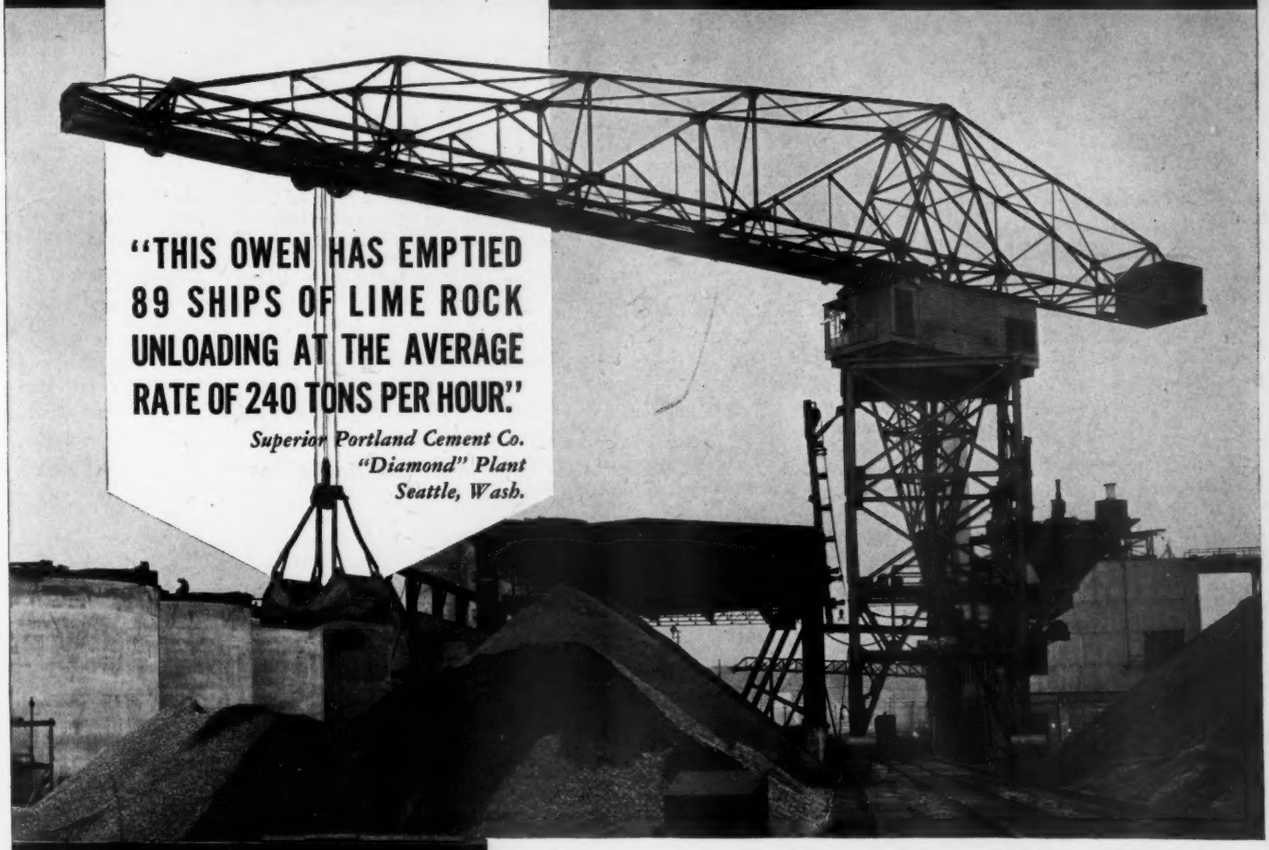
Idaho Portland Cement Co., Pocatello, Ida., has closed its plant until its stock of cement and clinker have been reduced.

Superior Portland Cement Co., Seattle, Wash., reelected E. P. Lucas as president at its board of directors' meeting January 11.

Yosemite Portland Cement Co., Merced, Calif., is operating its quarry to build up stocks of lime rock during good weather.

OVER A MILLION TONS

TO ITS CREDIT . . . . . AND NO REPAIRS



"THIS OWEN HAS EMPTIED 89 SHIPS OF LIME ROCK UNLOADING AT THE AVERAGE RATE OF 240 TONS PER HOUR."

Superior Portland Cement Co.
"Diamond" Plant
Seattle, Wash.

At the Diamond Plant of the Superior Portland Cement Company, an Owen Clamshell Bucket handles all unloading and rehandling of material from shipshold to dock, and from dock to plant. Its average bite is a 6-Ton mouthful, in well-settled lime rock. • A positive example of Owen speed, operating efficiency, and unusual durability—proved by 31 months' steady performance. A total of 2,300,000 tons of material has been unloaded and rehandled. The only repairs needed were rebushing of sheaves and one new pin. • The unique 15-Ton crane, on which the bucket operates, was built by the Colby Steel & Engine Company of Seattle—who selected the Owen. • Owen has proven its superiority in the rehandling of all types of materials not only in cement plants but in any installation where speed, increased production, and durability are of essential importance. Operators and owners who know buckets prefer an Owen.

THE OWEN BUCKET COMPANY, CLEVELAND, OHIO

A MOUTHFUL AT EVERY BITE

Owen Buckets

Recognized the World Over as the Leader in Its Field

Rock Products

With which is Incorporated CEMENT and ENGINEERING NEWS Founded 1896

Entered as second-class matter, July 2, 1907, at the Chicago, Ill., postoffice under the Act of March 3, 1879. Copyrighted, 1932, by Tradepress Publishing Corporation

Contents for February 13, 1932

The Soapstone City.....25-28
Virginia Alberene Corp., Schuyler, Va., has a unique industrial community. By H. Herbert Hughes.

Canadian Rock Products Developments.....29-31
By W. B. Lenhart.

Cement Plant with Interesting Control of the Raw Mix.....32-34
Southwestern Portland Cement Co., Victorville, Calif., with raw materials of more than usual variation maintains uniformity by careful control.

New Light on the Grading of Aggregates.....35-37
Reviewed by Edmund Shaw.

Relation of the United States Bureau of Mines to the Nonmetallic Industries.....38-43

Plant Is Center of Circular Storage.....44-47
Unusual stockpiling system at Twin Cities Sand and Gravel Co., Minneapolis, Minn.

Economics of the Nonmetallic Mineral Industries..48-49
Part XII—Water and motor truck transportation. By Raymond B. Ladoo.

A Limestone Tester for Field Use.....50-51
By Paul Emerson.

Investigations at the Bureau of Standards Dealing with Masonry Construction, Cement, Lime, Gypsum and Stone.....52-59

Sand and Gravel Producers Discuss Bituminous Roads.....74-77
Final session of Pittsburgh convention given over largely to discussion of use of gravel with asphalt or other bituminous mixtures.

Departments

Chemists' Corner.....60-61
Hints and Helps for Superintendents.....62-63
Rock Products Clinic.....64
Editorial.....65
Financial News and Comment.....66-67
Traffic and Transportation.....70-71
Foreign Abstracts and Patent Review.....72-73
Ed. Shaw's News Letter from Los Angeles.....78
Safety Campaigns.....80-82
Cement Products.....84-86
New Machinery and Equipment.....88-91
Portland Cement in December—and Preliminary Totals for the Year.....94-96
Prices of Materials.....97-99
News of the Industry.....100-102
Classified Directory of Advertisers.....104-108

(Rock Products is indexed in the "Industrial Arts Index," which can be found in any Public Library)

TRADEPRESS PUBLISHING CORPORATION
542 South Dearborn Street, Chicago, Illinois, U. S. A.

Nathan C. Rockwood, President; Fred S. Peters, Vice-President
T. I. McKnight, Secretary; Irene H. Callender, Treasurer

NATHAN C. ROCKWOOD, *Editor and Manager*
EDMUND SHAW, Los Angeles, Calif., *Contributing Editor*
EARL C. HARSH, WALTER B. LENHART, H. O. HAYES, *Associate Editors*

A. M. STERN, *Assistant Editor*
FRED S. PETERS, *Advertising Manager*
JOS. J. KOLAR, *Production Manager*

E. H. PAULL, *Eastern Representative*
250 Fifth Ave., New York City. Tel. Ashland 4-4723

GEORGE M. EARNSHAW, *Central Advertising Manager*
2380 Winfield Ave., Rocky River, Ohio. Tel. Boulevard 4353

NORMAN BOGGS, C. L. WALKER, *Western Representatives*
Chicago. Tel. Wabash 3714-3715

SUBSCRIPTION—Two dollars a year to United States and Possessions. $4.25 a year to Canada (including duty) and to foreign countries. Twenty-five cents for single copies

TO SUBSCRIBERS—Date on wrapper indicates issue with which your subscription expires. In writing, to have address changed, give old as well as new address

The A. B. P. is a nonprofit organization whose members have pledged themselves to a working code of a practice in which the interests of the men of American industry, trade and professions are placed first—a code demanding unbiased editorial pages, classified and verified paid subscribers, and honest advertising of dependable products. The A.B.C. is an organization which audits and verifies publishers' circulation claims and records.